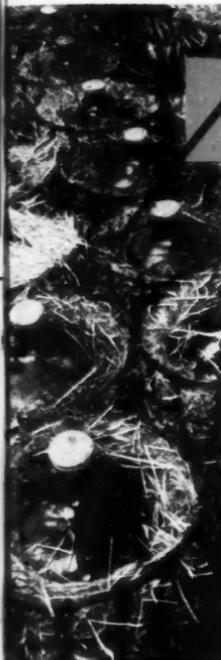


The Chemical Age

VOL LXVIII

4 APRIL 1953

No 1760



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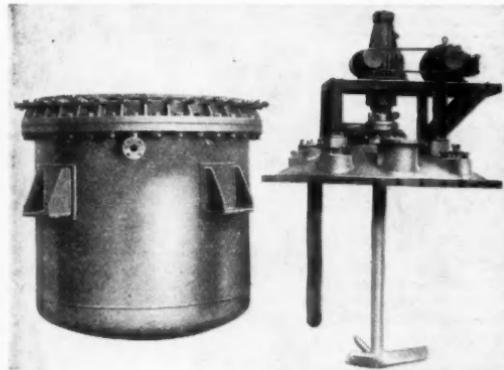
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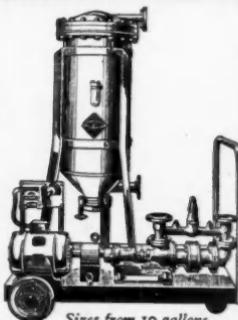
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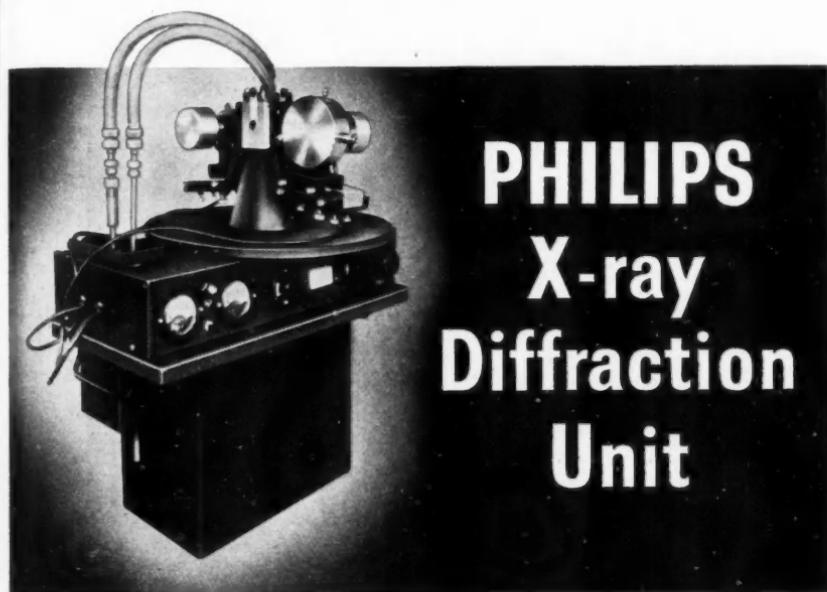
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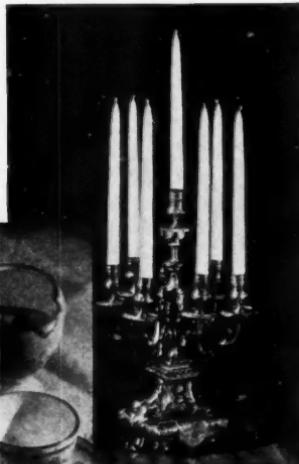
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Volume LXVIII

4 April 1953

Number 1760

With Deepening Concern

THE latest Report from the Department of Scientific and Industrial Research—for the year 1951/52 (HMSO, 8s. net)—must not be regarded as another addition to an annual series in pattern. For the first time the Advisory Council's general report adopts a critical attitude towards the Government. Previously critical comment has been restrained to the point of inarticulation. It might be over-dramatic to say now that the gloves are off; indeed, metaphors of this kind never apply to inter-departmental struggles, though real progress might often be speedier if they did. But economies have been imposed upon the DSIR and at the same time essential post-war plans of re-building and expansion have seen no further fulfilment.

In our last Report we expressed considerable anxiety at the delay in giving effect to DSIR's post-war plans. We pointed out that they had been approved by Government in 1946 as the minimum necessary to enable DSIR to play its part in ensuring that science

made its full contribution to national problems and particularly to securing industrial efficiency. We urged that special steps should be taken to remove the obstacles hindering the development of these plans . . . Nothing has since occurred to mitigate our anxiety. In fact, we find ourselves reviewing the relation between our scientific needs and our scientific resources *with steadily deepening concern.* (Our italics.) That is, and most commendably, the opening paragraph of the Advisory Council's Report.

The Advisory Council's forthright statement refers only to the absence of activity in fulfilling approved post-war plans. This sacrifice alone is more than the country can afford, but it is not all that the DSIR has had to face. In the Report of the Committee of Council, it is revealed that staff reduction has also taken place. On 1 October, 1951, the non-industrial staff employed was 3,079 but at the same time a large number of authorised vacancies also existed. The number the DSIR is now authorised to

employ is 3,054 — that is, all the vacancies have been erased and a further reduction by 25 on the existent staff has been imposed. This sorry revelation is prefaced with these words: 'In the economic position which prevailed at the beginning of the year we reluctantly decided that some contribution must be made by the Department to the general economies that were being made in the Government Service as a whole.' The re-deployment of staff that became necessary through these economies was made mainly at the expense of the Building Research section. There have been public criticisms of that decision, but it is undoubtedly wiser to reduce one activity sharply than to apply smaller but frustrating reductions to all activities. However, the total decrease in staff has not been 25. When industrial as well as non-industrial staff figures are studied it is found that the total decrease between 1951 and 1952 is 53. Percentage-wise this may amount only to about 1.25 per cent, but that ignores the invisible staff reduction brought about by cancelling the large (but unspecified) number of DSIR vacancies that existed in 1951. We might well guess that the true measure of the staff cut is at least 7 per cent and possibly as much as 10 per cent.

These are deplorable facts. They indicate that at high levels in this

country's administration there is still a costly and pathetic lack of appreciation for the potentialities of science. There is no scarcity of evidence that every penny previously expended upon the DSIR's multiplicity of research has been most profitably re-paid. There is an abundance of post-war evidence to show that the industrial futures of nations rest heavily upon science and scientific development, upon the wider application of technical knowledge already available and upon the undelayed introduction of new technical methods. In both of this country has all too often been slow, out-matched not only by the United States whose resources are so much greater, but out-matched also by smaller countries such as Holland and Switzerland. We find it impossible to understand how politicians and administrators can regard it as a genuine economy to curtail DSIR facilities and resources. From time to time flattering speeches are made about the work of British scientists and the part that science must play in the national economy and recovery. The DSIR Report shows that lip service is still one of the principal occupational diseases of politicians. The 'steadily deepening concern' of the DSIR's Advisory Council must be shared by everybody interested in either research or production. It is not too late for a profoundly stupid policy to be reversed.

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Notes & Comments

Gallium Identification

IN a current chemical dictionary gallium's principal use is still listed as that of substitution for mercury in high-temperature thermometers. A number of once-scarce metallic elements have remarkably expanded their technologies and uses in the past ten years, but gallium does not seem to have shared in this movement. Its physical property of melting at under 30°C. but not boiling at under 1,600°C. suggests that it could serve a wide range of purposes in modern industry, but its supply problem would no doubt discourage potential applications. Gallium is widely distributed but it generally occurs only in trace amounts. Extraction costs are always likely to be high. A sign of greater interest in this element is the report of a new method for identifying gallium in the presence of aluminium (*Chem. & Engng. News*, 31, 9, 876). Trace amounts of gallium are usually, and perhaps invariably, found in aluminium ores. Spectroscopic rather than chemical-analytical distinction has been the means of detection. The new method is organic. The addition of ammoniacal acetylacetone to an aqueous ammoniacal solution of both chlorides produces monoclinic crystals of the acetylacetones; but if the solution is initially acid, only the gallium organic compound will be formed. This compound being soluble in excess acetylacetone can be separated by this means. It should be added that the technique is micro-analytical.

Fertiliser Recovery

SOME weeks ago, under this same heading (CHEMICAL AGE, 68, 299-300) we suggested that 1953 was likely to be a turning-point in the fertiliser industry's recent minor depression. This was a view based upon advance indications of farming demand this spring. Now, more retrospectively, it is clear that this has been one of the most active spring seasons in the whole history of the industry. Taking an annual tonnage picture, it is unlikely that 1952/53 sales

will reach the levels of the two years preceding subsidy removal; but during the spring period itself farmers' demands have probably exceeded all previous figures. Buying habits have changed awkwardly during the two years of subsidy removal. Farmers have always preferred to take delivery of their fertilisers at or very close to the time of use, and when the annual tonnages fell it was possible for them to do so without much risk of delayed or very late deliveries. This year, against a background of rapidly rising demand, most of them have continued to expect the same day-of-use or week-of-use delivery service. Throughout March the pressure upon fertiliser factories has staggered even the most hardened veterans. It might have been easier to contend with had the extent of increased demand been clearly foreseeable last autumn, but even as late as November it was by no means certain that farming demand for fertilisers would greatly exceed that of last year. There was therefore a prudent limit to winter stock-building, and in many factories stocks melted away in late February and early March. Usually in the spring there is some respite to be gained from wet weather, which holds up planting and drilling and delays the urgency of demand. The spring drought—unparalleled for some 70 years—provided no such breathing period. There is no doubt that many farmers have had to sow without waiting for fertilisers and will apply top-dressings later instead. For the future, farmers will have to relearn the old and hard facts—first, that no large-scale industry can hope to deliver 70 to 80 per cent of its annual output in the narrow space of about eight weeks; second, that no industry can carry advance stocks for its consumers if they do not indicate the likely quantities of their needs some months previously. This year it has been a common experience in the industry to receive telephone calls from farmers requiring a delivery within two days for so many acres of wheat or barley about to be sown.

Keeping Prices High

CONDITIONS appear to be very similar in the United States. In *Chemical Week* (72, 10, 34) one of the leading U.S. fertiliser industry executives reveals an almost identical story of spring-rush traffic. With the steady growth of the industry since 1939, setting aside the British recession of 1950/52 which was due to abnormal politico-economic factors, it is increasingly clear that there is a serious clash between buyers' seasonal habits and the steady all-the-year-round production requirement of the industry, a requirement that must be satisfied if low-cost production is to be achieved. The resolution of this distributional problem is probably more important than any single and more technical factor. Each year of expanding demand makes the problem more costly. It is no exaggeration to compare it with the rush-hour problem of London's train and bus services. No other basic chemical industries have to face so difficult a crisis of peak-demand, or would be expected to do so at such low margins between costs and prices.

Tax Relief Necessary

SPEAKING at the annual dinner of foremen employed at the Billingham Works of Imperial Chemical Industries, Ltd., Mr. S. P. Chambers, a director of the company, said that if the Chancellor could give a small taxation cut to individuals and companies this year, a small increase in production would result. With hopes of a bigger cut next year, the country would be on the high road to a higher standard of living. Mr. Chambers stated that Billingham Works were in many ways the most important part of the I.C.I. organisation. Increased productivity depended upon the amount of capital behind each workman and the effective use of equipment. In the U.S.A. the amount of capital behind each workman was 2½ times that of Britain and in 1951 the amount of new capital put behind each worker in America was ten times that of Britain. One of the troubles of British firms was excessive taxation. If firms were heavily taxed they could not save, and they could not get the extra capital needed to

increase productivity and keep ahead of competitors.

Digital Computer for Shell

AN ORDER has been received by Ferranti, Limited, from Royal Dutch/Shell Group to provide an electronic digital computer for use in their large research establishment in Amsterdam. The machine will be housed in a new laboratory now under construction. Including installation and ancillary equipment the value of the order is approximately £100,000, a welcome contribution to the nation's export drive.

It will be the first electronic digital computer that Ferranti, Limited, have been called upon to make for purposes other than academic or governmental use and will be the first large machine they will supply to a commercial undertaking. This type of apparatus, number 6 of a series designated 'The Manchester Universal Electronic Digital Computer,' will be used for the extensive calculations required in research in petroleum chemistry and engineering.

IN THE EDITOR'S POST

Large Size Measuring Flasks

SIR.—As leading producers ourselves of volumetric laboratory glassware, we have naturally been interested in the letter from your correspondent, Mr. S. H. Elliott, on page 284 of your issue of 14 February last.

Not only is Mr. Elliott correct in his assumption that there is a demand for large size measuring flasks, but he may be interested to know that appreciating that there is this regular demand, particularly for the 5 litre size flasks, we have ourselves, for some time now, been carrying stocks of the 5 litre size. Admittedly, the demand is small, as is only to be expected, but it is a regular one, and at the moment we have in stock in our warehouse, over three dozen flasks of this capacity.

We feel that this information may be of interest to any users who have occasion to employ flasks of this size at any time, or who may have been interested in your correspondent's letter.

Yours faithfully,
A. G. P. POWELL.

Sales Manager,
Baird & Tatlock (London), Ltd.

Factory Equipment Exhibition

Safety & Efficiency the Keynote

SOME 95 firms from all parts of Britain were represented at the first Factory Equipment Exhibition at the Royal Horticultural Society's New Hall, Westminster, London, S.W.1, from 23-27 March.

The main object of the exhibition was to stimulate the interest of directors, works and factory managers, welfare officers, personnel managers and all those concerned with the control of factories and works departments in the most modern equipment designed to contribute to the safety and welfare of employees and to increase their efficiency.

Industrial electric ovens suitable for temperatures 0-450°C. in a range of sizes complete with forced air circulation, automatic temperature control, and flameproof elements for use where there are volatile vapours were shown by A.E.W., Limited, of Edgware, Middlesex. A wide range of electric furnaces for industrial and laboratory use was also shown. These are supplied for all voltages and temperatures 0-1,250°C. Any type of temperature controllers or pyrometers can be fitted.

How 'Formica,' a laminated plastic veneer made in a variety of colours, meets the needs of hospitals, laboratories, clinics and dispensaries, canteens, and so on was demonstrated by Thomas de la Rue & Company, Ltd., London. 'Formica' is not affected by the majority of acids and alkalis, oils or foods. It resists heat up to 266°F. (130°C.) as well as impact and abrasion.

Fine Grinding Process

A new cost-saving process for fine grinding, lapping and polishing steel, stainless steel, chromium, stellite, tungsten-carbide, quartz, ceramics and so on to a fine micro-finish was introduced on the stand of Engis, Ltd., London. Hyprez Diamond Compound, as it is called, is contained in a sealed cartridge which fits into the Hyprez applicator gun. Each grade of compound can be easily distinguished by its identifying colour visible through the cartridge glass and opening in the gun barrel.

'Autolec' steam raisers similar to those installed at the Fulmer, Bucks, laboratories of the Monsanto Chemical Co., Ltd., were displayed by G.W.B. Electric Furnaces, Ltd.,

of Dudley, Worcestershire. A flow diagram illustrated the application of an 'Autolec' electrode water boiler to a thermal storage system.

Industrial fabric gloves processed with 'Helvin'—a thermoplastic material—were on view at the stand of Hellermann Electric, Ltd., of Crawley, Sussex, and were also worn by some of the models in the parades of protective clothing and equipment given in the cinema. 'Helvin' gloves were introduced only a year ago but are already widely used for protection against abrasion, acids, alkalies, salt solutions, greases, mineral and vegetable oils and alcohols. Customers' own gloves, depending on the quality of the fabric, may be processed with 'Helvin' at a reasonable cost. The company also makes coated aprons (PVC) and Neoprene coated boots for the chemical industry.

Metallic particle elimination by means of its 'Metaltector' equipment was demon-



The Duke of Edinburgh watching vibro-electric equipment demonstrated by Podmore (Engineers), Ltd.

strated by the Loma Electronic Equipment Co., Ltd., London, which specialises in industrial metal detection. The instrument can be arranged to give audible or visible warning, to stop the conveyor belt, or to drop a marker on the band. Special ejection systems can be fitted so that the contaminated products can be diverted without stopping production.

Non-Slip Surfacing

A sound precaution against accidents and delays due to slippery conditions on floors, stairs, ramps, in corridors and around machinery is the 'Safety Walk' non-slip surfacing made by the Minnesota Mining & Manufacturing Co., Ltd., of Birmingham. The new type 'B' cleats consist of extremely hard mineral grains surface-coated to a heavy, tough, treated fabric with a pressure-sensitive adhesive in place under a protective backing. On removing the backing the cleats can be easily rolled or hammered to the surface to make complete contact. 'Safety-Walk' "Type A" (non-self-adhesive) is still available for use where difficulty is experienced in obtaining a clean dry surface.

Three items being publicly shown for the first time by Northide, Ltd., Stockport, Cheshire, were a new series of PVC foul-weather garments, the 'Northern' glove—an unique heat-resisting glove, and the 'Sonex' ear defenders for workers in noisy departments. Chemical resistant aprons, clothing and headgear of PVC were also displayed together with a wide range of industrial safety gloves.

A wide range of vibro-electric equipment was shown by Podmores (Engineers), Ltd., of Shelton, Stoke-on-Trent, Staffordshire, including screens for fine screening of wet or dry products, test sieve vibrators for laboratories and feeders for regulating the flow of various materials to process plants. Process machinery included high speed mixers for mixing slips and slurries and glandless centrifugal pumps for handling abrasive slurries.

Care of the hands in industry is being realised as increasingly important, and Rozalex, Ltd., Manchester, once again had on view a wide range of barrier creams for application before work and a series of after-work creams for cracking, irritation and chafing of the skin.

A plastic emulsion coating which is odourless, quick drying and easy to apply, is the

Silexine plastic emulsion coating (SPEC) shown by Silexine Paints, Ltd., London. Also exhibited was the company's stone paint, a tested damp proofer and Silexine machinery enamel specially prepared for finishing machinery and metal articles generally.

An economical and simple method of eliminating dust from concrete or granolithic floors which will increase their resistance to wear, damp, acid and oil is the Watco concrete hardener demonstrated by Watco (Sales), Ltd., London. There is no chemical action, but the hardener acts as a mechanical binder, penetrates into the surface and makes the floor non-absorbent.

Some interesting developments in the field of protective clothing and equipment were seen in the parades given in the cinema by two men and two women models. These included self-contained breathing apparatus by Siebe, Gorman & Co., Ltd., Surbiton, Surrey, for use in poisonous or otherwise harmful atmospheres for a duration of 25 to 75 minutes. The equipment included an easily accessible gauge so that the wearer could see how the air supply was lasting.

Goggles, a respirator for protection against dust and paint spray, and a new lightweight plastic 'Pulsafe' face shield by Safety Products, Ltd., London, were worn by both men and women models.

The first waterproof boot to have a built-in toe cap core of tested steel was demonstrated in the parade by the Dunlop Rubber Co., Ltd., both in knee and ankle lengths. Acid resisting equipment shown by the company included knee length boots, and aprons and gloves of PVC.

Protection Against Heat

Two exhibits reminiscent of H. G. Wells's 'Shape of Things to Come' were a complete outfit—helmet, suit and boots of asbestos—which allows firemen to enter burning buildings with a maximum degree of safety, and a suit for protection against heat of a new material designed by the Leathercloth Division of Imperial Chemical Industries, Ltd. The suit is claimed to reflect away 98 per cent of the heat, and it was said that a workman wearing this outfit was able to stand for 20 minutes at the mouth of an open furnace without discomfort.

Smart headgear and 'snoods' to protect the hair, a transparent boiler suit, and tailored overalls of nylon and 'Terylene' were also displayed.

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CO-OPERATION between primary producers of polyvinyl materials and engineering companies specialising in the manufacture of machinery for the plastics industry has enabled the extrusion of rigid PVC to be most economically undertaken. The term 'rigid' used in this connection means totally unplasticised, and it is because powdered PVC can be extruded without the addition of a plasticiser that a heavy demand from chemical manufacturers is foreseen.

The primary raw materials for the manufacture of PVC tubing are produced in Britain by two companies, British Geon, Ltd., and Imperial Chemical Industries, Ltd., both of whom are actively interested in this development. Among the engineering firms catering for this new industry are R. H. Windsor, Ltd., Britain's largest exporters of plastics machinery, which specialises in the production of injection and extrusion moulding machines for thermoplastic materials. At the British Industries Fair in May, last year, this company gave what was believed to be the first demonstration at any British exhibition of the extrusion of chemical piping by a continuous process. The powders used were unplasticised Geon 101 and Geon 202, made from indigenous basic materials by British Geon, Ltd., in their factory at Barry, Glamorganshire.

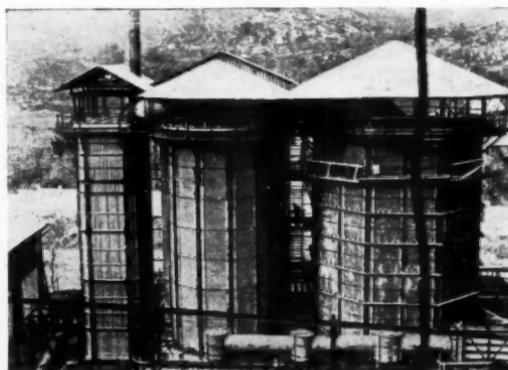
Among the most important properties of the Geon 100 series resins are thermal and

light stability, toughness and chemical inertness. In common with other vinyl materials Geon 101 and its variants are resistant to a wide range of chemicals, including most acids, alkalis, oils, greases and solvents other than cyclic and ketonic types. The Geon 200 series are high molecular weight copolymers of vinyl chloride and vinylidene chloride. Geon 202 is slightly more thermoplastic than Geon 101, but in other respects its general properties are the same.

Although the omission of plasticisers from polyvinyl compositions based on Geon 101 and 202 makes processes like extrusion more difficult, important properties such as chemical resistance are definitely enhanced. For example, plasticised PVC may be used in contact with most acids at moderate strength, but rigid PVC can withstand the same acids at much higher concentrations. Moreover, rigid PVC contains no plasticisers which can migrate, and this material therefore has advantages where this factor is important; for example, in food handling.

The earliest attempts to extrude PVC without added plasticisers, were unsuccessful. It was found that the single screw type of extruder normally used in Britain and the U.S.A. was incapable of handling such an intractable material as unplasticised PVC although it could deal satisfactorily with low plasticised vinyl resins of low molecular weight in the form of free-flowing powders.

Gay-Lussac towers at the sulphuric acid works of A.P.E., Vado Ligure, Italy. PVC tubing is used throughout in this plant





Hard PVC tube 33 CM.ID

This difficulty has been overcome by the use of multi-screw extruders, and R. H. Windsor, Ltd., are manufacturing machines of this type under licence from L.M.P., of Turin, Italy.

In these machines the multi-screw principle of operation, which is now well-known, is unique in that constant outputs of extruded products can be obtained with the most difficult materials. The conventional single screw is replaced by two or more intermeshing screws which rotate in the same direction, so that any material fed into the inlet hopper must be squeezed through the extrusion barrel. The screws are driven by a variable speed motor and the energy inputs to the heated zones are automatically regulated.

An automatic feeding device is incorporated in the extruder to provide a means of metering accurately the quantity of plastic material supplied to the extrusion screws. Thus tubes up to 6 in. diameter can be continuously extruded at high production rates and with the minimum of attention. Three multi-screw machines are in production and are known respectively as the R.C. 65, R.C. 100 and R.C. 200, the nominal output per hours being denoted by the figure included in the designation.

Normally, PVC powder is premixed, milled, sheeted and cut up into slabs, chips or cubes—a process which adds appreciably to the final cost—before being fed into a machine to make the finished product. One of the most valuable gains which have resulted from the use of multi-screw

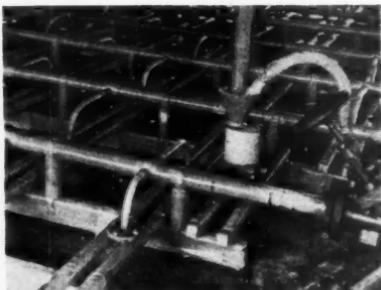
machines is that the raw material in powder form can be fed into the extruders in place of the orthodox solid chips or cubes. This advantage, which results in a substantial reduction in production costs, is due to the built-in compounding action of the extrusion machine.

There are quite a few types of PVC resins of distinctly different characteristics when processed without plasticiser. R. H. Windsor, Ltd., have been experimenting with materials supplied by British manufacturers of vinyl resins in order to find out which types could best be produced for the general market.

British Geon, Ltd., have recently introduced two new types designated Geon 101 EP and Geon 103 EP, both of which are suitable for the production of rigid PVC. Geon 101 EP is a high molecular weight polyvinyl chloride resin, similar to Geon 101 in its physical properties, but capable of being extruded at a faster rate and in some cases at lower temperatures. The extrusion rate has been increased by as much as 10-20 per cent and for certain compounds it is possible to reduce the temperature by 10-30°F. Geon 103 EP is designed to process at lower temperatures, while maintaining the recognised advantages of Geon 101.

Although the lower optimum processing temperatures of Geon 103 EP would seem to indicate a reduction in high and low temperature properties, laboratory tests show that there is no significant difference between compounds based on this resin and on Geon 101. The processing temperatures of these resins would appear to fall between those of Geon 101 and Geon 202.

Rigid PVC has been produced on the



PVC tubes for the preparation of sulphuric acid at the A.P.E. works, Italy

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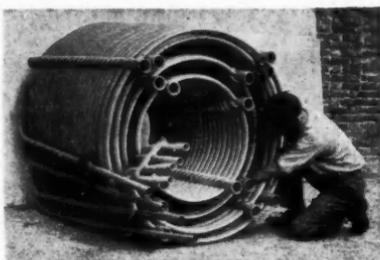


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Continent for many years and at least one French firm is exporting extruded products to the U.S.A. on an extensive scale. In Germany some 1,200 tons were consumed during one of the war years in the form of piping for chemical plants alone.

Interest shown by the British chemical industry in the development of rigid PVC for piping, sheeting, joints, funnels, containers, and so on, has been enhanced by the scarcity and high prices of such metals as copper and mono-nickel. Because of its special qualities, however, rigid chemical piping made of unplasticised PVC is still likely to find a ready market even when alternative materials are again in plentiful supply.

An important point which has yet to be decided in both Britain and the U.S.A. is whether a lead stabiliser can be accepted for any sheet or piping which will come into contact with food or water. A non-toxic material based on the Goodrich Co.'s 404



Four range P.V.C. coil

Government by a company in Massachusetts, which incidentally is using machines exported to America by R. & H. Windsor, Ltd. Organic tin stabilisers have proved in the U.S.A. to be particularly suitable for unplasticised vinyls. Stabiliser companies in Britain are becoming increasingly appreciative of the large potential market which exists and organic tin compounds of British manufacture are now becoming available.

Chemical Engineers

Graduates' & Students' Meeting

THE week-end of 17-18 April promises to be an entertaining and interesting one for members of the Graduates' and Students' Section of the Institution of Chemical Engineers.

Proceedings begin on Friday (17 April) with a symposium on 'Effluent Disposal' to be held at University College, Gower Street, London, W.C.1. The symposium will be in two sessions, the first devoted to 'The National Problem' and the second to 'The Industrial Problem.'

In Part I, Dr. B. A. Southgate (director, Water Pollution Research, DSIR) will give a paper on 'Statutory Obligations and the Nature of the Problem,' and speakers on 'Some Other Factors' will be H. Cary Gibson (director, Freshwater Biological Association, Windermere Laboratory); C. D. Mulvey (secretary, Anglers Co-operative Association); and J. I. Spicer (chief pollution and fisheries officer, Trent River Board). Part II will be opened by C. Lear (Imperial

Chemical Industries Ltd.), with a talk on 'The Chemical Industry.' R. F. Stewart and C. J. Smith will follow and will discuss 'Plant and Equipment.'

Under the heading 'Some Specific Problems,' J. J. Priestley (W. C. Holmes Ltd.) will deal with 'Gas Works Liquors,' R. H. Burns (AERE, Harwell) will describe 'Radioactive Effluents' and E. F. Rose (British Electricity Authority) will tackle the problem of 'Waste Heat Disposal.'

The symposium will be wound up by the 'Conclusions' of Professor D. M. Newitt (chairman, Water Pollution Research Committee, DSIR, and past-president, Institution of Chemical Engineers).

On Saturday morning (18 April) the annual general meeting of the section will be held at University College.

After the meeting, members have been invited to tour the chemical engineering department, see the laboratories and inspect some of the research work that is in progress.

The section's annual dinner and dance will be held in the evening at the 'Chez Auguste' restaurant, 47 Frith Street, Soho, London, W.1, beginning at 7 p.m.

A 'Movable' Solid Floor

Simple Process Reduces Building Costs

A NEW type of heavy duty flooring suitable for chemical works and factories is shortly to be marketed in Britain.

Known as 'Stelcon' Steel Clad Rafts this new flooring is strong yet movable. It can be put down in the minimum of time and be worked upon immediately.

'Stelcon' rafts combine sub-floor and wearing surface. Simply and quickly laid on a bed of sand evenly compacted over top-soil, they form strong level floors capable of resisting very heavy wear.

The rafts are large concrete slabs doubly reinforced throughout, bound by angle iron and have the 'Stelcon' steel clad wearing surface. Each raft is approximately 6 ft. 6½ in. by 6 ft. 6½ in. by 4 in. thick (200 cm. by 200 cm. by 10 cm.) and the weight is approximately 22 cwt.—4.6 cwt. per sq. yd.

In a new construction a 'Stelcon' raft floor can be put down as the first building operation, and it is claimed that by this means it is possible to reduce building costs by 7 per cent. Furthermore, the floor can be rearranged subsequently, as required, to meet altered lay-out of plant.

Alternatively, should any subsidence occur in the subsoil, the floor level can be restored by the simple expedient of raising the necessary number of rafts, filling in with more sand and relaying the rafts in position.

There are two small holes in each raft into which lifting bolts are fixed for handling by crane from one or two points of suspension. A forklift truck may be used as an

alternative method of handling, stacking and laying the rafts.

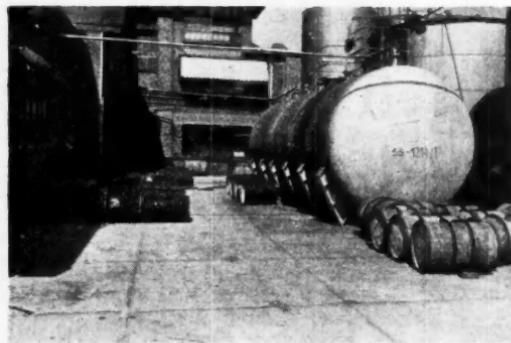
Rafts on a site should never be stacked more than 10 high, and there should be three supporting blocks between each. The points of support should always be placed vertically one above the other. The blocks must not be placed on the angle iron frame.

The company marketing this new industrial flooring, Stelcon (Industrial Floors), Ltd., Cliffords Inn, London, E.C.4, has issued an illustrated leaflet giving full details of its various applications.

Although new to Britain it is stated that over 500,000 sq. yd. of rafts have been laid on docks and in factories since the war, including the docks at Rotterdam and Amsterdam. Some floors of this type are reported to have been laid for 16 years, without any expenditure in maintenance.

To Absorb Gases

AN agreed statement has now been issued about a recent conference on the subject of offensive smells reaching the Wirral area which for some time have been the subject of complaints by residents. The statement, issued by all parties concerned, states that Courtaulds, Ltd., have for many years devoted much effort and expenditure to research concerning treatment of exhaust gases from their factories, and have from time to time introduced modifications to their plants. 'It is now hoped that, by the erection of a new type of absorber tower, a satisfactory method of treating the gases can be evolved.' Courtaulds have already started to build such a tower, and, if it fulfils expectations they will build others.



'Stelcon' steel clad raft flooring

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MIDLANDS SOCIETY FOR ANALYTICAL CHEMISTRY

Analytical Chemistry of Tin & Lead—Part I

A meeting of the Midlands Society for Analytical Chemistry held recently in Birmingham, the subject chosen for discussion was introduced by Dr. J. W. Price of the Tin Research Institute. Following are his remarks and subsequent discussion on the analytical chemistry of tin:—

The two series of tin salts, stannous and stannic, exhibit a number of differences in their reactions that are of analytical importance. Stannous salts are reducing agents, mercuric salts being reduced by them to mercurous and then to metallic mercury; bismuth salts are converted to the metal by alkaline stannites. This latter reaction is used in the detection of stannite in the stannate electroplating bath. A sensitive test for stannous tin, which, of course, is not specific, is the formation of molybdenum blue by reduction of molybdate. Stannous salts in solution absorb oxygen readily at elevated temperatures, but only slowly at room temperature; they are quantitatively oxidised to stannic salts by oxidising agents such as iodine.

Stannic salts, on the other hand, show no reducing properties, but are readily reduced to the stannous form by reducing agents.

On treatment with sodium hydroxide both series of salts give precipitates of hydroxide, which are readily soluble in excess alkali to form stannates and stannites, the latter being unstable, two molecules of stannite reacting to form one molecule of stannate, and precipitating one atom of tin.

Tendency to Hydrolyse

Stannic salts show a strong tendency to hydrolyse, making it possible to obtain colloidal solutions of stannic hydroxide, which can exist either as sol or gel. The properties of the gel are so variable that it was previously supposed that there were many different stannic acids. An α - and a β -(meta) stannic acid are now recognised, the α -acid being formed by neutralisation of a solution of a stannic salt by alkali, and the β -acid when metallic tin is treated with concentrated nitric acid. There are many intermediate forms between the α - and β -acids, the β -form being the more stable. The adsorptive power of stannic acid for

electrolytes, particularly for phosphoric acid, is well known. This diminishes with rise of temperature and also with increased particle size.

The volatility of the stannic halides, and particularly of the chloride and the bromide from the solutions of the corresponding acids, as compared with the non-volatility of the stannous salts, is made use of in a number of ways. The classical scheme for the separation of arsenic, antimony and tin by successive distillation of $AsCl_3$, $StCl_4$, and $SnBr_4$, is well known, though not much used today. Distillation of stannic bromide is used for the recovery of small amounts of tin, from, for example, foods and biological material.

The main value, however, of the volatility of the tin halides lies in the possibility of the removal of large amounts of tin by evaporation before determination of other elements in the non-volatile residue. Arsenic and antimony are removed with the tin and there is some loss of bismuth, unless perchloric acid is present to prevent the temperature from increasing too much.

Titrimetric Methods

The best known and most accurate method for the determination of tin is the volumetric titration of stannous tin with standard iodine or iodate:—



The general method is to boil a hydrochloric acid solution of the tin with some reducing metal, the choice of which lies between antimony, iron, lead, nickel, aluminium and zinc; all of these metals have been shown to give accurate reduction of tin under the appropriate conditions. Aluminium and zinc behave differently from the other metals in that they reduce the tin directly to the metal, which then has to be dissolved in the stannous condition after the reducing metal has all dissolved.

Iron, lead, aluminium and zinc will precipitate copper and antimony from solution, and it has been shown that if, as is often the case, the tin solution to be reduced contains either of these metals, appreciable amounts of tin are lost by co-precipitation. Metallic antimony does not precipitate

copper or antimony from solution, but when used in powder form, it appears capable of producing low or high results according to the fineness of the powder. In addition, there is a variable effect due to after-reduction in the cold and the action of iodine on the remaining powder. Thus, accurate results can only be obtained by a balancing of errors. Nickel on the other hand, has been claimed to give accurate results in the presence of both antimony and copper, the precipitates of these metals being free from occluded tin. Where the colour of the solution produced by nickel reduction is an objection, the use of aluminium is becoming increasingly popular, particularly for the reduction of fairly pure tin solutions.

Reducing Power Utilised

Attempts have been made to take advantage of the rapid reducing power of antimony by using a 50 per cent iron-antimony alloy as the reducing agent, in the form of coarse powder. This material does not remain suspended in the solution, so that the end-point of the titration is more easily seen. Short reducing times, of the order of 5 minutes, are stated to be sufficient, and the alloy may be used a number of times. It is available in the States under the name of 'Stanreduce.'

In the presence of large amounts of antimony and copper it is sometimes preferred to make a preliminary separation of these metals before reduction of the tin.

A non-metallic reducing agent, hypophosphorous acid, has been suggested for the determination of tin. Antimony is also reduced, but only to the trivalent form, while arsenic is reduced to the metal. Both iron and copper interfere, and must be absent. The method has not been much used except for the analysis of stannate plating solutions. Recently, a modification of it has been put forward for the analysis of copper-base alloys, in which the copper (I) is precipitated as thiocyanate in a strongly acid solution and the tin titrated without filtration.

Interfering Elements

The interference due to titanium, which may be serious when iodine solutions containing dissolved oxygen are used for the titration, can be eliminated by adding excess KI.

Antimony, bismuth, copper, arsenic and tungsten can all cause high results. The first

four are precipitated as finely-divided metals by a metallic reducing agent, and on titration with iodine will reduce some of the stannic chloride formed, giving a further consumption of iodine. In addition, antimony and copper can carry down some of the tin with them when a metal other than antimony or nickel is used for the reduction. Tungsten interferes by giving a blue colour to the reduced solution and so masking the end-point. Metallic iron will separate all these impurities from solution together with a little tin. This tin must be recovered by redissolving the precipitate and re-precipitating with iron. Vanadium and molybdenum also give coloured solutions and interfere in the same way. These elements are sometimes present in tin ores and are best removed by a preliminary treatment with acid. While ferrous chloride has no effect on the titration, the small amounts of impurity present in iron crucibles or even iron powder are known to consume iodine. This difficulty is sometimes avoided by standardising the iodine solution against a solution containing a known amount of tin and also about the same amount of iron as is introduced into the determination.

A standard solution of iodate/iodide is considered preferable to the more usual iodine solution. This is standardised under exactly the same conditions as in the determination.

Gravimetric Methods

The time-honoured method of weighing the ignited insoluble residue produced by nitric acid attack on an alloy containing tin is still widely used. It is often sufficiently accurate for routine control if the weight of tin oxide found is corrected for the impurities present. Of those impurities phosphorus is usually the most important. It should also be remembered that the presence of more than about 0.25 per cent of iron in the alloy will cause incomplete precipitation of the tin, while any antimony present will be included with the tin.

If dilute nitric acid is used, solution of the sample will generally be rapid, with formation of soluble tin nitrate, and it will be necessary to evaporate the solution to dryness to convert the tin to the insoluble metathannic acid before filtration. If more concentrated acid is used, the tin is converted to the insoluble form immediately, but dissolution of the alloy is slow, particularly if

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it has a high phosphorus content, and there is danger of considerable contamination of the tin precipitate. The solution should be kept hot during filtration otherwise some of the tin may pass through the filter.

An alternative method which is capable of results of high accuracy is the precipitation of the tin-tannin complex and subsequent ignition of the precipitate, after washing free from chloride, to SnO_2 . Precipitation is brought about in slightly acid solution (about 0.05N) by flocculation of the disperse hydrated stannic oxide by the negative tannin sol. The precipitate obtained is coarsely flocculent and settles quickly. In chloride solutions, tin is readily separated from copper, lead, iron, aluminium, vanadium and beryllium. Arsenic is not precipitated by tannin, but antimony, titanium and zirconium are coprecipitated with the tin. In solutions containing oxalate the tin-tannin complex separates and can be filtered rather more readily than in chloride solutions, and in this medium, tin can be separated from zirconium, though antimony still interferes, and tantalum and niobium are partly precipitated, and can be separated by fractional precipitation. It will be remembered that Schoeller and his co-workers established a serial order of precipitability of the metal-tannin complexes in oxalate solutions of the elements of Groups IVA and VB.

It may be mentioned here that cupferron is an excellent precipitant for tin if the solution under examination is free from other metals, as is the case when stannic bromide has been separated by distillation. The cupferron complex, in which the tin may be co-ordinated with the nitroso-group, filters easily and can be ignited to SnO_2 in the usual way.

Phenylarsenic acid also forms a complex with tin in acid solution which may be filtered and ignited to SnO_2 and has the added advantage of affording a separation from copper, lead and zinc. Direct precipitation of the tin from a solution of such alloys as gunmetal makes this reagent attractive, apart from its high cost.

Colorimetric Methods

The number of reagents producing coloured solutions with tin salts is somewhat limited. Of the reagents that have been proposed the majority are at best only semi-quantitative; others are non-specific, as for example phosphomolybdic acid which is

reduced to molybdenum blue by stannous tin. Cacotheline, which has been used for the detection of stannite in tin plating solutions, gives a violet colour with stannous tin and other strong reducing agents. The colour fades rapidly and is not suitable for quantitative purposes. The same applies to other reagents such as Diaxine Green and to quinalizarin, which forms a pink lake with stannic tin. The only reaction which is specific for tin is the formation of red precipitates with dimercapto-benzenes, the constitution of which is so far unknown. The best reagent for the purpose is 4-methyl-1:2-dimercaptobenzene (dithiol), which is available commercially.

The Reagent Solution

The reagent solution contains 0.2 per cent dithiol in 1 per cent sodium hydroxide to which is added 1 per cent of thioglycolic acid. This solution is oxidised in air with formation of a white turbidity and should be freshly prepared before use. Bismuth is the only other metal to produce a red coloration with dithiol, while copper, nickel and cobalt give black precipitates. With other metals the colours produced are various shades of yellow, which do not interfere provided that the dithiol is in excess. Phosphates interfere and in their presence a separation is necessary.

Originally the tin-dithiol complex, being a precipitate, was stabilised by the addition of agar-agar, and the colour in the solution measured visually by reflected light, either by comparison with standards or with the Lovibond Tintometer. Recently it has been shown that various dispersing agents produce suspensions that are stable for a number of hours and can be measured photometrically. Using the Snellker absorptiometer an Iford Green 604 filter is suitable, and Teevol has so far proved the most satisfactory dispersing agent. By this procedure concentrations of tin up to 300 p.p.m. can be measured satisfactorily. The reagent has also been applied successfully as a spot test for the detection of tin in lead and zinc base alloys. The chloroform solution of tin oxinate can be used for colorimetric measurement, but a preliminary separation of the tin is necessary and this makes this reagent rather unattractive.

Polarographic Methods

Stannous tin produces a well-defined anodic wave in alkaline tartrate solutions

due to oxidation to stannic tin, and a good cathodic wave corresponding to the reduction of stannous tin. In this medium no wave is given by stannic tin. Owing to the difficulty of obtaining the tin in a completely reduced state it is preferable to work with solutions of stannic tin.

Waves Measurable

In acid solution only badly defined waves are given by stannic tin unless the solution contains an excess of chloride. In chloride concentrations of 4N and above a well-defined double wave is obtained from the reduction of the chlorostannate complex, SnCl_6 , first to SnCl_4 and then to the metal. The first diffusion current is not completely developed before the second wave begins, but the total current is well-defined. Either the first wave, the second wave or the total double wave may be measured. It is easier to use the second wave for measurement as it is not then necessary to correct for residual current. The half-wave potential of lead coincides with that of the second tin wave, so that a correction must be made for any lead present.

Lead produces a single well-defined wave in a number of media, both acid and alkaline, the solution used depending on the presence of other metals. For example, alkaline tartrate or citrate is suitable for the determination of lead in the presence of tin, bismuth or cadmium. No wave is given by stannic tin in sodium hydroxide solution while lead gives good waves, so that this solution is also suitable for the determination of lead in presence of tin. In both these solutions the diffusion current constant for lead is rather smaller than in acid chloride solution, so that a correction of the lead wave height must be made before subtracting from the combined lead-tin wave.

Acidity Reduced

A method which avoids this difficulty involves reduction of the acidity of the chloride solution after measurement of the lead-tin wave to a pH of 2.5-3.0 so that the tin is precipitated and does not give a wave, a fresh measurement of the wave-height giving the lead content alone. Care is needed in precipitating all the tin and none of the lead. The most satisfactory method, when two aliquot samples are available, is to measure the combined tin-lead wave in acid chloride solution with one aliquot and to treat the second aliquot

with hydrobromic acid and bromine to volatilise the tin and then measure the residual wave, which is due to lead alone, in the same medium as the first aliquot. This method has given excellent results with samples of various foods and products, in which lead was present, in most cases, in relatively minor concentrations.

Recently it has been found that in acid chloride solutions, the presence of small amounts of tetraphenyl arsonium chloride causes a shift of the potential at which the first tin wave appears, so that it is possible to measure a diffusion current for tin which need not be corrected for moderate amounts of lead.

Differential Polarography

By superposing a small alternating potential (10-100mV) on a D.C. potential applied to the dropping mercury electrode, a small alternating current is obtained with the same frequency but a varying amplitude depending on the applied D.C. voltage.

It has been shown that this alternating current reaches a maximum at the half-wave potential and that this maximum is proportional to the ion concentration. The use of suitable electronic amplification permits the introduction of a smoothing device which completely smooths out current oscillations due to the dropping electrode.

While with D.C. polarography it is necessary to plot a current-voltage curve, with the differential method it is only necessary to adjust the D.C. potentiometer until a maximum reading is given by the galvanometer (or other form of recorder), which takes place at the half-wave potential. Then comparison with a calibration curve gives directly the concentration of the substance.

The magnitude of this maximum alternating current is substantially greater than the corresponding D.C. diffusion current, thus enabling higher accuracy of measurement.

Since the A.C. polarogram of an ion is not affected by the preceding discharge of other ions, small amounts of less noble metals can be determined in the presence of an excess of nobler ones, e.g., mixtures of Cd and Zn in the ratio of 100:1 can readily be determined. Further while in D.C. polarography a difference of at least 100 mV between two half-wave potentials is needed in order to measure the individual step-heights, a separation of only 40 mV is sufficient to distinguish between two substances

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by A.C. polarography. This being the case it should be possible to separate tin and lead in acid solution by this method, the difference of potential here being 50-60 mV.

Electrodeposition

Tin was at one time determined in white metals by electrolysis of an oxalic acid solution from which antimony and copper had been separated by H_2S . It was usual to electrolyse at low current densities for a long time, often overnight. The deposited tin may be contaminated by nickel, zinc or iron, and the method is not now much used.

Recently successful deposition of tin from pure solutions of the chloride has been described, using the method of controlled potential developed by Sand. A rather more complex scheme describes the successive deposition of copper, bismuth, lead and tin from a tartrate solution at controlled potentials, the solution being acidified for the determination of the tin.

Zinc-base Alloys

Those alloys which contain only traces of tin and lead can be successfully analysed by the polarographic method, as described in B.S. 1225. The sum of tin and lead is obtained in hydrochloric acid containing bromide; lead is determined in alkaline solution and the tin found by difference. Interference is caused by iron and copper; the former is reduced to the ferrous state by hydrazine, in which form it does not interfere, while copper may be removed by electrolysis or its wave compensated instrumentally.

A purely chemical method for the determination of tin which gives excellent results, provided a 100 g. sample is available, is the precipitation of the tin together with a little aluminium with tannin by neutralising a hydrochloric acid solution of the sample. Reprecipitation from oxalate solution gives a pure precipitate which is ignited and weighed as SnO_2 .

Titrimetric determination of tin may be carried out on a 20 g. sample by dissolution in hydrochloric acid, reduction with Al and titration with dilute iodate. If copper is present, any tin co-precipitated must be recovered.

Iron & Steel Analysis

Many steels contain small amounts of tin, often introduced from scrap. Except in tool steels, small amounts (0.1 per cent) have no

serious effect on mechanical properties, but larger amounts are detrimental. In cast irons, tin is said to inhibit graphitisation.

In the case of plain carbon steels tin may usually be determined by direct titration after solution in hydrochloric acid. With highly alloyed steels, however, this direct method is not applicable and a preliminary separation of the tin from interfering elements is necessary. This is usually accomplished by separation as sulphide with the addition of molybdenum as collector. Tin is then precipitated with ammonia from a solution of the sulphides, redissolved in hydrochloric acid, reduced with aluminium and titrated as usual.

In the case of a few special steels, e.g. those containing tantalum and niobium, preliminary separation of the tin by distillation of the bromide has been recommended.

A polarographic method has been described, in which the sulphide precipitate is ignited, fused with bisulphite and the tin precipitated with ammonia. This precipitate is dissolved in hydrochloric acid, iron reduced with hydroxylamine, and the tin polarographed as usual. This method has given good results with standard samples and is rather more rapid than the standard method.

Food & Biological Materials

Tin has no known toxic action and the suggested limit of 250 p.p.m. in foods represents a perfectly adequate safeguard for the consumer.

Wet oxidation of organic matter is to be preferred, as with dry ashing the tin may be converted to an insoluble oxide which must be fused with alkali to bring it into solution.

The method used for the determination of the tin will depend to some extent on the amount likely to be present. If moderately large amounts are present (750 p.p.m.) a direct titrimetric method can often be used, as interfering elements are not likely to be present. For the same reason, precipitation as the sulphide and ignition to oxide can give good results if care is taken to prevent contamination with silica, calcium salts or phosphates.

For smaller amounts of tin the choice lies between the colorimetric dithiol method and the polarograph. Both of these are capable of yielding good results, although with the former a preliminary separation as

sulphide may be necessary to avoid the interference of phosphates. An alternative method of separation which has been used successfully with food samples is the distillation of the tin as stannic bromide.

The polarographic method has also been used successfully for food samples, containing small amounts of tin (1-2 p.p.m.). The only difficulty here is in the interference of lead, though with food samples the proportion of lead to tin is likely to be low. It has been found that oxides of nitrogen in traces of organic matter remaining in the solution after wet oxidation can produce abnormal waves; to avoid this, tin is separated by adding an Al salt as collector and precipitating with ammonia. The precipitate is filtered and redissolved in hydrochloric acid.

White Metals

Tin, except in amounts under 0.5 per cent, is invariably determined titrimetrically in white metals, e.g., solders, bearing metals, etc. The sample, containing 0.3-0.5 g. of tin, is dissolved in concentrated sulphuric acid or hydrochloric acid, any residue being dissolved by addition of 2-3 ml. of 5 per cent potassium chlorate solution. Impurities are precipitated by treatment with 5 g. of iron powder, and the solution filtered through a coarse paper into a conical flask. The filtered impurities are redissolved in hydrochloric acid and chlorate and again treated with iron in order to recover occluded tin. The solution is again filtered, the filtrates combined and the tin reduced in absence of air with nickel, or preferably, with aluminium and titrated with iodate in the usual way.

Small amounts of tin, e.g., in pig lead can be separated by co-precipitation with manganese dioxide. The sample is dissolved in dilute nitric acid (1:4) heated to boiling and solutions of permanganate and manganese nitrate added. Boiling for two minutes produces a precipitate of MnO_2 which carries down most of the tin and any arsenic and antimony present. This is filtered off, and dissolved in sulphuric and nitric acids. Tin may then be determined in this solution in the usual way.

Copper-base Alloys

Preliminary separation from copper can be carried out in many ways, e.g., precipitation of the copper as thiocyanate or oxalate, precipitation of the tin with nitric acid or

ammonia, or distillation of the tin as bromide, and the method used will depend on the personal choice of the analyst and the type of material being analysed. In outlining the following methods it is not suggested that they are the only ones suitable, but it is claimed that they give reasonably accurate results and are reasonably rapid.

For amounts of tin above 2 per cent in alloys containing less than 5 per cent lead the sample is dissolved in aqua regia, a little ferric chloride added and the solution made alkaline with ammonia. The mixed tin and iron precipitate is filtered on a rapid paper, washed free of copper and dissolved through the paper with hydrochloric acid. Tin is then determined gravimetrically with tannin or volumetrically by reduction with nickel or aluminium in the usual way.

For small amounts of tin, e.g., in copper-lead alloys, a separation of the tin with nitric acid from a 5 g. sample is the simplest method. The precipitate and filter paper are dissolved in sulphuric and nitric acid, and the tin determined as above.

A rapid polarographic method has been described in which copper is removed from a hydrochloric acid solution of the alloy by electrolysis at a controlled potential (-0.36 V against the S.C.E.), and separate aliquots of the solution remaining are polarographed for lead in N NaOH and for tin in N HCl and 4M ammonium chloride.

(To be continued)

Brotherton Lecture

The fourth Brotherton Memorial Lecture will be delivered on Monday, 13 April, at 6 p.m. at the University, Leeds. Professor J. B. Speakman, D.Sc., F.R.I.C., F.T.I. (Hon.), will speak on 'The Chemical Revolution in Textile Technology.' The chairman and committee of the Yorkshire Section of the Society of Chemical Industry are inviting those attending the lecture to tea which will be served in the Textile Department Museum from 4 to 5.45 p.m.

U.S.-Brazilian Project

A DDT and caustic soda-chlorine plant is to be built in or near Sao Paulo by two U.S. firms—W. R. Grace and American Home Products—in collaboration with the local firm of Medicamento Fontoura, S.A. The plant, it is reported, will be capable of producing 4,000,000 lb. of DDT a year, and 10 tons a day of chlorine.

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Electricity & the Chemist

Equipment at the Electrical Engineers' Exhibition

SIMPLICITY and economy was the theme of the second Electrical Engineers' Exhibition held at Earls Court, London, from 25-28 March under the auspices of the Association of Supervising Electrical Engineers. Many scientific and technical devices, instruments and control gear of interest to the chemist and the chemical engineer were on view.

A wide range of specialities covering electrically heated plant and apparatus for industrial processes in many trades was shown by Barlow-Whitney, Ltd., London. New 1953 products included a box oven for drying out welding electrodes during storage and prior to use, and a muffle furnace, general purpose type, designed for use at temperatures up to 1,000°C. Also among the latest additions to the 'B.W.' products was a humidity test cabinet specially developed for testing electrical equipments.

Small standard electric furnaces, heaters, insulation and refractories representing only a part of its wide range of equipment were displayed by R. M. Catterton-Smith, Ltd., Wembley, Middlesex. In addition to its standard furnaces within the temperature ranges 500°C.-1,750°C. (932°F.-3,210°F.), any special requirements can be catered for. Intermittent and continuous furnaces (lehrs) are also built for glass annealing, heat treatments and general and special laboratory and production purposes.

Electrothermal Rubber Sheeting

Many problems of localised heating in industrial processes have been solved by electrothermal rubber sheeting (E.R.S.) which was demonstrated by Electrothermal Engineering, Ltd., London. E.R.S. is, to all intents and purposes, a flat sheet of rubber—with all that this description connotes in the way of strength, adaptability, flexibility, insulating and water repelling properties—but it is electrically wired to radiate heat at controlled temperatures up to 200°C. The company also manufactures electrothermal heating equipment suitable for most applications both in the laboratory and for pilot plant as well as various forms of energy regulators and pyrometers for the accurate control of heating equipment.

Present day load conditions necessitate closer attention being paid to the performance of transformers and other equipment. The 'Silvertown' Acitest unit exhibited by Gulf Oil (Great Britain), Ltd., London, provides an easy method for testing the acidity of transformer oils in service in the field thereby giving an indication as to the condition and possible need for further action.

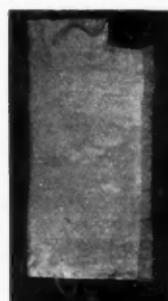
An air conditioned bench for welding or assembly work was one of the main features on the stand of Hirst Electronic Development, Ltd., London. Other 1953 products on view included a 'B.H.' welding machine, and a 25/75 kVA precision half-cycle welding machine.

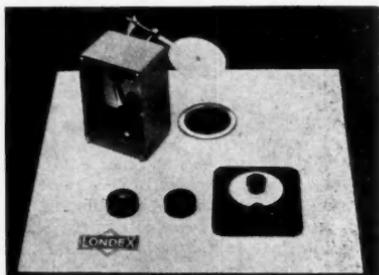
New developments in Isomantle surface heaters were to be seen among the exhibits of Isopad, Ltd., London. Some of the latest items included a metal-clad Isomantle heating an enamelled cast iron vessel of 20-gallon capacity; Isopanels, flexible heating panels used for heating and compensating duties on all types of cylindrical vessels up to large tanks of 20 tons and for many other applications in various industries; Isotopes, used in large quantities for pipe tracing and similar duties; and an Isopanel used as an infra-red space heater. Another achievement is the 'Multisize' Isomantle which can be used to heat a variety of flask sizes.

A comprehensive display of industrial electrical equipment including time switches, geared motor units, and flameproof equipment was exhibited by The Jeary Electrical Co., Ltd., London. The company has



Isomantle on a sulphonating pot (above) and an 'Isopanel' flexible heating panel seen on the stand of Iso-pad, Ltd., London





An air flow switch, one of the working exhibits demonstrated by Londerex, Ltd.

played an important part in the standardisation of geared motor units thereby easing the problem of replacement of parts.

Industrial electronic equipment was well represented on the stand of Lancashire Dynamo Electronic Products, Ltd., Rugeley, Staffordshire. Smaller exhibits included simple photoelectric switching units, welding and process timers and various units in the protective and supervisory field. Interesting examples of process control equipment were multi-interval timers for sugar centrifuges where as many as five intervals on banks of up to 12 centrifuges may be controlled, providing a total of 60 timing operations in a single equipment. Other aspects of the process controlled field were covered by apparatus for the control of temperature, pressure, flow and other variables encountered in industrial processes. Among the photoelectric equipment was a smoke density indicator for conditions in factory and similar chimneys. A comprehensive synchronous resistance welding control installation was also on view.

Liquid Level Control

A number of interesting working models attracted considerable attention on the stand of Londerex, Ltd., London. A new version of the company's 'Lectralevel' supersensitive floatless liquid level control, showed that by a simple system of electrodes and a relay equipment, the control of level of high resistance liquids, such as condensate, could be affected. Another compact unit was an air flow switch with a positive action shown working together with a small blower; signal lamps indicated when there was no air flow. Photoelectric control for counting articles on a moving belt, and pressure switch and flow

guard equipment which could be operated by visitors to produce conditions on 'no flow' and 'no pressure' were other interesting exhibits.

Among the industrial process control equipment shown by Sunvic Controls, Ltd., was a glandless float-operated liquid level controller embodying a single-pole double-throw micro-switch providing 'on-off' control or 'high-low' level alarm. Other items on view included a range of adjustable bimetal thermostats, including water-heater and oven thermostats, and energy regulators for infinitely variable control without resistance loss.

The many applications of nickel and high-nickel alloys could be seen on the stand of Henry Wiggin & Co., Ltd., Birmingham, including 'Brightray C,' a long-life alloy for heating elements operating at temperatures up to 1,150°C. A range of the company's excellent technical publications was available.

Applications of electricity in agriculture and horticulture could be seen on the stand of the British Electrical and Allied Industries Research Association. Models showed new soil warming apparatus for tomato houses and nursery frames, and methods of using electricity for drying hay in a barn and for the destruction of soil pests.

Canadian Fertiliser Production

FACTORY value of fertilisers produced in Canada during 1951 rose to \$84,258,000 from the preceding year's total of \$78,755,000 the Bureau of Statistics reports. Output of mixed fertilisers totalled 696,600 tons valued at \$29,193,000 as against 669,900 tons at \$26,819,000 and superphosphate, ammonium nitrate (fertiliser grade) and ammonium sulphate, 824,500 tons at \$43,326,000 against 839,000 tons at \$40,622,000.

There were 39 plants engaged principally in the manufacture of fertilisers in 1951 with a factory selling value of products of \$74,489,000 as compared with 36 plants with a production value of \$68,997,000 the year before. These plants furnished employment for 3,218 persons who were paid \$10,310,000 in salaries and wages as compared with 3,253 persons paid \$9,423,000 in 1950. Cost of materials used was \$35,294,000 compared with \$33,350,000.

Indian Newsletter

FROM OUR OWN CORRESPONDENT

THE sixth annual general meeting of the Indian Institute of Metals was held at Bangalore between 26 and 28 February, 1953. The meeting was attended by metallurgists from various parts of India, and two Japanese delegates of the Nippon Steel Works. Mr. Phiroz Kutar, general manager of the Tata Iron and Steel Works, presided. The Indian Section of the Electrochemical Society met concurrently and a joint symposium was held with the Institute on 'Electrolytic Alkali Chlorine.'

In his address the president dealt with some raw material problems of the iron and steel industry in India. He referred to the difficulty in meeting the chemical requirements of steel-making-grade of ferromanganese which were Mn 80 per cent and P 0.35 per cent. The ferro-manganese manufactured indigenously assayed Mn 70 per cent and P 0.6 per cent due to low grade of manganese ore used, low efficiency of manganese reduction and the 0.2 per cent phosphorus content of the coke used.

Because of the decided advantages resulting from the low-shaft furnace for producing standard grade ferro-manganese, the Council of Scientific and Industrial Research was seriously considering the installation of a low-shaft furnace pilot plant in India. The address further referred to the essential raw materials, namely, iron ore, coal, flux, oxygen and ferro alloys. The problems of shortages had to be met by finding alternative sources of supply and those of quality had to be solved by beneficiation or modification of the processes.

There was a special lecture by Sir C. V. Raman, N.L., on 'Atomic Vibrations in Solids.' Some 16 technical papers on diverse facets of ferrous and nonferrous metallurgy were presented in four technical sessions and evoked considerable discussion. There was a seminar on 'Hardness of Metals.' In the joint symposium with the Electrochemical Society, eight papers were read which dealt with the utilisation of chlorine in electrolytic production of metals, use of chlorine in treating sulphide ores in making carbon tetrachloride, calcium chloride and chlorinated rubber and the economics of alkali chlorine.

Delegates visited the Mysore Iron & Steel

Works at Bhadravathi, and industrial establishments in the State.

A three-day symposium on 'Industrial Failures of Metals and Alloys' was held in early February at Jamshedpur under the auspices of the National Metallurgical Laboratory, and 29 papers by scientists from India, U.K., U.S.A., Australia, Norway, Germany and Japan were presented. Dr. C. E. Phillips, Department of Scientific and Industrial Research, U.K. was among the delegates to the symposium.

The Geological Survey of India has recently reported the location of what is believed to be the biggest massive sillimanite deposit in the world in the Khasi and Jaintia Hills District of Assam. The sillimanite reserves are estimated at about 251,000 tons up to a depth of 20 ft. only. The mineral is of a high grade quality and is believed to have a ready foreign market for various refractory and industrial purposes. The Survey has also investigated limestone deposits in Bihar and the presence has been established of an estimated reserve of nearly 3,000,000 tons of crystalline limestone in the Hazaribagh District, which could be used in the manufacture of portland cement. A second deposit in the Chota Nagpur area is being investigated.

Further evidence of the keen desire of Japanese industrial firms to get established in India is contained in the report of the signing of a provisional agreement between the Government of Mysore and the Nippon Glass Company of Japan for establishing a glass plant for which equipment and technical skill for erection and initial operation of the plant would be provided by the Japanese firm. The Government of Mysore State is also said to be negotiating with a Japanese firm for the manufacture of high tension insulators at the Government porcelain factory at Bangalore. The scheme envisages an expenditure of 7,500,000 rupees and manufacture of 24,000 tons of high tension insulators per year. If agreement is reached, the Japanese firm would supply and erect the necessary machinery and also provide technical assistance.

Productivity Council

Scheme to Help Interchange of Ideas

AIMS of the British Productivity Council and its proposed programme of action as successor to the United Kingdom section of the Anglo-American Council on Productivity were outlined at a conference held in London on 19 March. Sir Peter Bennett, the chairman, presided, and the conference was attended by several hundred members of the 66 teams which visited the U.S.A. under the auspices of the AACCP. Representatives of the employers' organisations and trades unions which sponsored the teams, and of other interested organisations were also present.

The constituent bodies of the British Productivity Council are the British Employers' Confederation, Federation of British Industries, Trades Union Congress, Association of British Chambers of Commerce, National Union of Manufacturers, and the nationalised industries.

Explaining the council's proposed proposed programme of action, Sir Norman Kipping said that there were three main starting points.

The Circuit Scheme

First, there was the Circuit Scheme under which individual firms were invited to enter a team, or more than one if they were able. The idea was that this team would be sent approximately once a month to visit one of the other teams in the same circuit, and in return a team from one of the other firms would be received. Teams would be based roughly on experience gained from the Anglo-American Council and would consist of six members—two from management, two from staff, and two from the workshops.

Applications, which it is hoped will be numerous, will be compiled by the council into circuits of 10 firms, chosen with an eye to the size of the establishments so that they are evenly represented. Once the circuits are made up, it is hoped that the system will run itself and that full advantage will be taken of the opportunities to study maintenance, organisation, production, mechanical handling, and so on and that the interchange of ideas will prove profitable.

In order to get interest in the work of the British Productivity Council as widespread as possible throughout Britain, 105 towns are going to be invited to form a Produc-

tivity Committee bearing the town's name. First initiative to call formative meetings will be taken by the 105 district committees attached to the Regional Boards for Industry which are joint committees of employers and trade union representatives.

Once formed, however, the Productivity Committee will be given the greatest freedom and left to work out their own methods. Help will be given by the council in three main ways.

First, by the provision of printed material dealing with the essential always-recurring elements of the productivity problem, for example, works study, lay-out flow, standardisation, simplification, and so on—all the common problems, in fact, on which there is so much room for understanding.

Secondly, it is hoped to provide for all these committees lecturers of the best quality to be sent at their request, but not at their cost, to assist them in whatever locality they decide upon.

Thirdly, some specialist films for educational purposes are being produced.

Finally, it is hoped to be able to provide financial assistance in at least two forms. One would be cash amounts of say £10 at a time, to cover costs of meetings, publicity, and if necessary the hiring of a hall and projector. The Association of Technical Institutes (comprising all the technical colleges), hopes to help with the loan of rooms, projectors and so on.

The other financial assistance would be to assist in providing an honorarium for the services of the part-time secretaries of the Productivity Committees who would no doubt be involved in a good deal of hard work.

Another very short type of film for the television service was also being prepared and the BBC had shown its interest in them.

The Camera in Industry

The value of photography to the oil-industry was well demonstrated in a small exhibition of photographs by the Royal Dutch-Shell group shown recently at the Kodak Gallery, Regent Street, London, W.1. The many varied aspects of the oil industry and the applications of photography to research, provided plentiful sources for dramatic pictures of which the best advantage had been taken.

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The Chemical Age 4 April 1953

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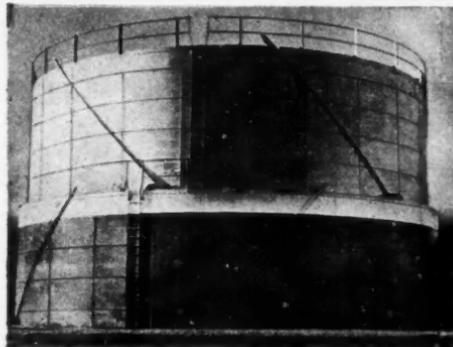
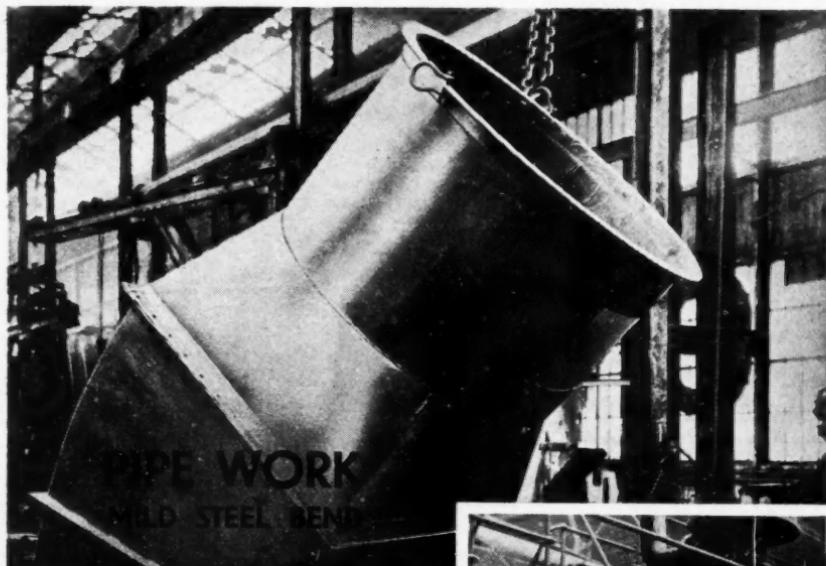
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Metallurgical Section

Magnesium Becomes a Structural Metal

Field of Applications Rapidly Expanding

REGARDED less than a quarter of a century ago as virtually a laboratory curiosity, magnesium is today a structural metal with a rapidly expanding field of applications. From a mere 280 tons in 1930, production in the United States rose to 40,914 short tons in 1951. Last year it soared to the record figure of 105,821 short tons, representing an increase of about 259 per cent in twelve months.

Such is the present-day importance of this relatively new material that the first International Magnesium Exposition ever staged was held in the Armory at Washington on 31 March, 1-2 April. Washington was selected as the location for this exhibition because, within a few hundred miles radius, a great concentration of military and government research and development work is being carried out. Although the event was sponsored by the Magnesium Association, exhibits were not confined to those of members. Invitations to exhibit were sent to all companies known to be associated in any manner with the industry in Canada, England, Norway, Sweden, France and Germany. American industry was, of course, prominently represented, as well as the U.S. Armed Services and government agencies.

Education the Key

The central theme of the exposition was educational, for the magnesium industry believes that the key to wider usage is education. In the central theme area visitors saw magnesium parts being drawn into finished shapes, there were shown how magnesium tubing is bent into shapes, and demonstrations were given to convince them that magnesium is one of the easiest metals to weld. Many products made from the metal were on view, among the most interesting being an all-magnesium motor car body designed and developed in Britain,

which weighs only 132 lb., can be lifted by one man, and is attached to a British-made chassis by only six body-mounting bolts. Another exhibitor from Britain showed a machine new to the United States, which makes accurate determinations of the compression yield strength of metals and will also take continuous X-ray photographs of metal specimens fed past the X-ray machine on a continuous conveyor.

Defence Stimulation

The success of magnesium is due largely to the achievements of scientists and technologists in solving complex problems of metallurgy and chemistry. The meteoric expansion in production, however, is also attributed to the requirements of national defence programmes. Magnesium is the lightest of all commercially available structural metals and its strength-weight ratio is the most favourable for aircraft, aircraft equipment, and items to be air lifted. These properties also account for the rapid expansion of commercial demand.

Another advantage of magnesium is that it can be extracted from seawater and is therefore in unlimited supply. The magnesium available in the oceans would cover the entire world's land area to a depth of nine feet. In the United States there are six government-owned magnesium plants in production, in addition to the Dow Chemical Company's plant at Freeport, Texas. Last year from 45 per cent to 50 per cent of the U.S. production was consumed, the balance being sent to the military stockpile. Of the magnesium used, about one-quarter was for civilian industry and three-quarters for military requirements.

The rest of the free world has been consuming, since 1943, only half as much, or less, than has the United States. In 1950, the only significant producers outside the U.S. were Britain (5,000 tons) and Canada

(1,700 tons). Germany was a leading producer up to 1945 and may become so again.

Twenty years ago Britain was entirely dependent on imported magnesium. In 1936, when the expansion of the RAF began, the only plant actually in production was a small factory which had been erected the previous year. The process employed used carbide of calcium as a reducing agent *in vacuo* at temperatures between 1,200°C. and 1,600°C. Deadburnt magnesite and carbide were heated in steel retorts in gas-filled furnaces, the magnesium distilling off and condensing within the hood in crystalline form. During the war the capacity of this plant was extended and the same firm operated a shadow factory on behalf of the British Ministry of Aircraft Production.

Electrolytic Process

Magnesium Elektron was formed in 1935 with the object of operating an electrolytic process, for which patent rights for the British Empire had been purchased from the I.G. Farbenindustrie. In this process magnesia is mixed with suitable reducing and other agents, including magnesium chloride solution. The mix is formed into pellets, which are lightly calcined and are then converted into molten anhydrous magnesium chloride. In the electrically heated chlorinators the temperature of the reaction zone reaches 1,100°C. The bulk of the chlorine consumed originates from the electrolytic cells, the remainder being fresh chlorine which represents the operating losses. While still molten the magnesium chloride so produced is fed into cells operating at about 750°C. In addition to the magnesium chloride, each melt contains other chlorides whose presence inhibits the decomposition of magnesium chloride at the cell-operating temperature and favourably influences the properties of the electrolyte. The electrodes are suspended perpendicularly and opposite to one another. The metal collects on the face of the cathode in droplets, which rise to the surface of the electrolyte and are removed at intervals. Current efficiencies of 50 per cent and over can be achieved. This process yielded the bulk of the magnesium produced during the war in both Britain and the U.S.

During the early war years production in Britain was expanded as rapidly as new plants and extensions could be brought into operation, a peak level of 20,000-30,000 tons

annually being achieved. Meanwhile, research and development allowed a reduction to be effected in the magnesium content of the incendiary bomb. This factor, together with the great increase of capacity in the U.S., led to such a favourable transformation in the supply position that several of the British magnesium factories were closed down. Due to large stocks left over from the war, the last remaining producer, Magnesium Elektron, Ltd., ceased the extraction of new magnesium in 1947, its plant being maintained as a war potential.

Before the war Britain's requirements of magnesia were obtained almost entirely from the calcination of magnesite from Austria, Greece, India and Manchuria. During the early war years Indian magnesite was shipped in sufficient quantities to keep works producing magnesium fully supplied. Eventually processes were developed in Britain for treating seawater with dolomite to recover magnesia in the form of magnesium hydroxide slurry. It then became possible to produce the metal from locally available materials. The British Periclase Co. was the first to treat seawater with calcined dolomite. Its original factory was eventually purchased by the Ministry and its output has been progressively increased.

Given equal prices for electric power and raw materials, the electrolytic process for the production of magnesium can be operated as economically in Britain as in the United States. Since all the raw materials needed can be obtained locally, the country's entire requirements of metal magnesium could be supplied from domestic sources. In 1951, the Ministry of Supply announced that measures to step up output of magnesium and to control supplies were being taken. Among these measures was the re-opening of one of the plants closed after the war, to process magnesia obtained from the sea water plant at West Hartlepool.

To Raise Production

The Aluminium Company of Canada plans to raise magnesium production at its Arvida, Quebec, plant to from 3,000 to 4,000 tons of magnesium metal per year. In return for a loan of \$2,200,000 towards the capital cost of this expansion, it has undertaken to supply 2,640 tons of magnesium a year to the United Kingdom for 20 years, beginning in 1954. Brigadier Mackeson, Secretary for Overseas Trade, was asked in the House of

while, a reduction in content was a factor. capacity trans- several were at over a producer, extrac- plant

ents of from Austria. the the shippe- s pro- Even Britain site to magnesium possible available was the dolom- ally pur- but has

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Commons why the Magnesium Elektron factory in Lancashire could not be used to meet the demand. In his reply, he stated that careful consideration had been given to the question of re-opening this factory before the agreement was made. In addition to other difficulties, however, the estimated cost of magnesium produced there would be substantially higher than that of the aluminium imported from Canada.

The report to President Truman prepared last year by the President's Materials Policy Commission—popularly known as the Paley Report—indicates that the estimated increase in consumption between 1950 and 1975 will be greater for magnesium than for any other metal, assuming no relative change in prices. The report indicates the possibility of an increase of 18.45 per cent over the 1950 consumption of about 20,370 tons. This would mean a hypothetical consumption of about 376,000 tons in 1975.

While pointing out that magnesium can be obtained at moderate cost in unlimited amounts, the Report emphasises that large-scale use awaits technical improvement in alloying and fabricating the metal. If these improvements can be achieved, there will be a tremendous future for magnesium, especially as a structural metal.

As happened with other metals, most of the early use of magnesium was in the form of castings, but a trend to wrought products developed. In structural applications, low density and relatively good strength-to-weight ratio are usually the properties on which the use of magnesium is based. Large quantities of cast magnesium alloys are being used in jet engines, and newer alloy developments are bringing about cast parts with even better mechanical properties at still higher temperatures than ever before. The most significant development in the field of wrought magnesium has been its use in major quantities for integral airframe construction.

Alloying Element

Magnesium is widely used as an alloying element in aluminium, the ratio being approximately one pound of magnesium per hundred pounds of aluminium alloy. Because it is chemically active in its molten state, it has been used to remove oxygen, sulphur and other impurities from less active metals. A new market in the metallurgical field with tremendous potential is nodular iron. A

small percentage of magnesium added to grey cast iron results in a material that is equivalent to a malleable iron.

Because of its ability to store up and release electrical energy, magnesium is finding a growing field of applications in cathodic protection and batteries. Magnesium anodes have proved effective in protecting underground pipe lines, steel towers, and lead-sheathed cable against corrosion. One of the latest applications, recently proved on a large scale, is the protection of the underwater surface of ship's hulls.

Several Advantages

Among the advantages of the metal is that alloys can be drawn from three to four times as deep in one operation as aluminium or steel. Allowable deformation increases more rapidly in magnesium than in any other commercial metal. At 600°F., magnesium has greater formability than steel, brass or aluminium at the same temperature. Spring-back decreases as temperature increases and is not encountered at 600°F. These advantages make it practical to fabricate in one piece a part which, if made from other metals, would usually be fabricated by riveting or welding. Other important advantages of single draws with magnesium are the elimination of all intermediate anneals and the need for only one set of draw dies. Magnesium can be severely drawn by working at an elevated temperature and at a critical speed coincident with its recrystallisation rate. It has been observed that increasing the speed of drawing at a given high temperature produces an increase in tensile strength of the drawn part.

In order to promote the use of magnesium, the U.S. Bureau of Mines is conducting basic investigations to develop the phase diagrams of various magnesium-rich alloy systems. A better understanding of phase transitions may lead to the development of new magnesium-base alloys having improved properties. Information concerning the reactions involved in the reduction of magnesia by ferrosilicon is being accumulated from laboratory investigations. This information is necessary to determine process and equipment modification for decreasing the cost of producing magnesium by the silico-thermic process.

Much work on magnesium is also being done by British research organisations. For example, in co-operation with the former

Engineering Division, the Metallurgy Division of the National Physical Laboratory carried out a series of tests on the effects of the addition of third elements on the creep resistance of magnesium-cerium alloys, and it was shown that the useful influence of manganese is accompanied by a modification of the precipitation reaction associated with the production of high creep strength in these alloys. The ternary system magnesium-zinc-zirconium is being investigated using micrographic and electrical resistivity methods. Compounds of zinc and zirconium are formed, which are somewhat soluble in solid magnesium at high temperatures and only sparingly soluble at lower temperatures. In co-operation with the British Welding Research Association, papers have been published on the weldability and weld strength of magnesium alloy sheets.

New Nitriding Plant

NITRIDING plant, manufactured by The General Electric Co., Ltd., has recently been installed in the Coventry works of Jaguar Cars, Ltd., where it is used for the surface hardening of crank shafts. The installation comprises a 56 kW pit furnace provided with fully automatic temperature control and reading apparatus, switchgear, ammonia flow panel, dissociation testing cubicle, and two heat-resisting steel nitriding containers equipped with fans and forced convection assemblies.

The containers are loaded by suspending the charge of crankshafts vertically from a casting carried by the suspension bars attached to the insulated lid. The lid and charge are then lowered into the envelope and bolted into position. An absolutely gas-tight seal is formed by the rubber joint between the lid and envelope. A nitriding atmosphere is used to purge all air from the container before the container and charge are placed in the furnace.

The furnace is kept at a controlled temperature of 500°C. at which heat the ammonia reacts on the nitrally steel crankshafts giving them a hard wear-resisting case. The depth of case is governed by the length of time the charge is held at temperature. A total heating cycle lasts from 60 to 70 hours, but during this period the plant requires very little supervision.

Spectrochemical Analysis

THE Industrial Spectroscopy Group of The Institute of Physics has formed a panel of members interested in direct reading equipment for spectrochemical analysis. These devices combine spectrographs with electronic equipment in such a way that the intensities of characteristic spectral lines give a direct reading of the percentage of the elements present in the specimen. The object of the panel is to organise meetings which would serve the interests of users and potential users of this equipment.

The first meeting arranged by the panel took place in the Institute's House on 26 March last when Dr. A. C. Menzies introduced the subject. Mr. A. L. Pendrey and Mr. R. T. Staples followed with accounts of their experiences in this type of work and there followed a general discussion.

Readers who would like notices of the meetings on this subject are invited to join the Group, particulars of which may be obtained from The Institute of Physics, 47 Belgrave Square, London, S.W.1.

New Research Centre

IT is reported that the proposals made by the Norwegian Council for Technical Research to establish a research centre at Blindern, near Oslo, have received strong support. Among the sixteen institutions which have expressed a wish to build or rent space in the proposed centre are the Paper Industry Research Institute, the Cement and Concrete Institute, the Electrical Materials Control and the Electric Supply Research Institute. A site has been given by the Government and it is estimated that it will cost in the region of £600,000 to build.

Apart from specialised institutes, the centre will provide premises for the Central Institute of Technical Research, established by the Technical Research Council. The Central Institute's function is to carry out research projects commissioned by particular industries or commercial undertakings against payment to be fixed by contract. In the last financial year the Institute had a budget of about £30,000 of which almost half was covered by receipts from commissioned research projects. The balance has been met by part of the profits earned by the State Football Pool.

Analysis of Zirconium

Part II—Quantitative

by T. O. PORTCASTLE, Ph.D.

ONE of the earliest methods utilised for the determination of zirconium in metallurgical materials turns to advantage the insolubility and constancy of composition of the compound formed on addition of phosphate ions to a solution of zirconium salts.

Claassen and Visser¹⁵ have recently re-investigated the phosphate method of Lundell and Knowles.¹⁶ The results obtained by their procedure using the theoretical factor for conversion of zirconium pyrophosphate to zirconium were always within 0.2 mg. of the true zirconium content. The phosphate precipitation was also examined in hydrochloric acid or tartaric acid solution and a perfect separation was obtained from aluminium, copper, cadmium, bismuth, nickel, cobalt, manganese, magnesium, tungsten, vanadium, molybdenum, uranium, the alkaline earths and the alkali metals. Large amounts of iron were troublesome and tin always interfered. When titanium was present in solutions containing hydrogen peroxide, satisfactory values were found only when the precipitate was of small amount.

No Conversion Factor

Ruff and Stephan¹⁷ commented on high results obtained in the determination of zirconium as zirconium pyrophosphate, and got favourable results without using a conversion factor, after fusion with potassium bisulphite in a platinum crucible and removal of platinum with sulphuretted hydrogen in acid solution. It was found that the separation from beryllium in dilute sulphuric acid by precipitation of the phosphate was satisfactory. The beryllium phosphate was thrown down by adding ammonia to the filtrate. The ignited pyrophosphate weighed a little too much, and it was therefore necessary to correct by a factor before converting to the corresponding weight of beryllium oxide. Cunningham and Price¹⁸ adapted the phosphate method to plain carbon and alloy steels. A 5-10 g. sample was dissolved in strong hydrochloric acid at 80°C. till reaction ceased. Hydrogen peroxide was added and the solution was heated for a few minutes and 7.5N ammonium

hydroxide was added till a faint permanent precipitate formed. This was taken up in 6N hydrochloric acid and 10 g. of sodium sulphite were added followed by concentrated hydrochloric acid. The zirconium was precipitated with diammonium hydrogen phosphate. Simpson and Schumb¹⁹ combined the selenite and phosphate methods in a procedure in which the zirconium was thrown down first of all as the selenite, dissolved in oxalic acid and re-precipitated by addition of hydrogen peroxide and diammonium hydrogen phosphate after regulation of the acidity.

Comparisons Made

Several papers have compared the phosphate method with others. For example, Hackl²⁰ compared the sensitivities of the phosphate and benzeneearsonic acid reagents. A solution of zirconium sulphate in 2 per cent sulphuric acid was prepared containing 0.1 mg./ml. and tested with 10 per cent disodium hydrogen phosphate in a volume of 100 ml. 1.0 mg. of zirconia in 15 min. gave a perceptible turbidity; 0.5 mg. of zirconia gave a turbidity in 1 hour and 0.1 mg. gave a turbidity only after three days. With benzeneearsonic acid a turbidity was obtained when 3-4 mg. of zirconia as sulphate were present in 100 ml. Coppieters²¹ found the phosphate method to be rapid, simple, specific, but rather unreliable. He preferred the ammonium arsenate method finding it to be rapid, exact, specific and reliable.

One of the new features of zirconium analysis by the phosphate method depends on the technique of homogeneous precipitation. Willard and Freund²² found that triethyl phosphate was completely miscible with solutions of zirconium and hafnium sulphates in dilute sulphuric acid, and that when such a solution was boiled, the ester hydrolysed in steps, forming a precipitate $ZrO [H(Et₂PO₄)_2] \cdot 2H_2O$. Incomplete hydrolysis of the triethyl phosphate was indicated by non-formation of $ZrO[H_2PO_4]_2$. When a mixture of hafnium and zirconium sulphates was treated with insufficient ester to deposit all the zirconium and hafnium, the ratio of hafnium to zirconium in the precipitate

tended to increase. In a series of 5-6 operations, taking a time of 20 hours per step, they achieved a complete separation of the two metals. The trialkyl phosphate method was further developed by Willard and Hahn.²³ In a volume of 150-200 ml. containing 2-500 mg. of zirconia, the acidity was adjusted to 3.6N sulphuric or hydrochloric acid, and 15-20 ml. of trimethyl phosphate were added. The temperature was maintained at just below the boiling point for 12 hours. The precipitate thus obtained (a mixture of zirconyl methyl phosphate with zirconyl phosphate), was more dense and more crystalline than that resulting from precipitation with diammonium hydrogen phosphate. It was filtered, washed with 250-300 ml. of cold 5 per cent ammonium nitrate, ignited and weighed as zinc pyrophosphate. Antimony, bismuth, cerous and stannic ions interfered with the determination, and high results were found when appreciable amounts of iron, titanium, thorium and uranyl ions were present.

In the same paper it was noted that when acidic solutions containing bivalent ZrO ions were treated with an excess of metaphosphoric acid, a precipitate of $[ZrO_2(PO_4)_2]$ settled slowly as a result of hydrolysis. This precipitate was not as dense as that obtained from the triethyl phosphate procedure, but was much better than the precipitate deposited by diammonium hydrogen phosphate. It too was formed in a 3.6N acid solution and was converted to pyrophosphate by ignition at 900-950°C.

Selenite Method

Another of the time honoured methods for zirconium analysis is based on the insolubility of the zirconium salt of selenious acid. The method was patronised by Simpson and Schumb in a series of papers appearing over a period of a few years. In determining zirconium in minerals the Muehlberg method of fusion with sodium peroxide and carbon was recommended,²⁴ the fusion being repeated in the event of any residue being insoluble in mineral acid. The melt was extracted with water and the soluble sodium salts rejected. The residue was dissolved in dilute acid and evaporated to fumes with 18N sulphuric acid. After removal of silica in the usual manner, the solution was made ammoniacal and filtered. The precipitate was promptly washed and dissolved in alcoholic hydrochloric acid. This solution was heated and the zirconium deposited as the

insoluble selenite by addition of selenious acid. When the supernatant liquid became clear, the precipitate of $4 ZrO_2 \cdot 3SeO_2 \cdot 18 H_2O$ was washed slightly and dissolved in 12N hydrochloric acid and re-precipitated with selenious acid with addition of perhydrol to reduce quadrivalent cerium. The two filters used for retaining the zirconium precipitates finally washed with 2.5 per cent oxalic acid and the solution was added to the main precipitate containing the zirconium, diluted and treated with 6N hydrochloric acid after boiling. It was subsequently allowed to stand for 12 hours and the precipitate was finally washed with 2.5 per cent oxalic acid in 0.24N hydrochloric acid. The filtrate containing zirconium was treated with 18N sulphuric acid and fumed to destroy oxalic acid. Precipitated selenium was filtered off and the filtrate made ammoniacal. Zirconium hydroxide was filtered and dissolved in concentrated hydrochloric acid. Perhydrol and 10 per cent selenious acid were added and the basic selenite ignited to the oxide and weighed as ZrO_2 .

Zirconium in Steels

In applying the selenite method to steels²⁵ Simpson and Schumb dissolved the steel sample in hydrochloric acid with addition of nitric acid. The residue was extracted with hydrochloric acid and water and the residue and extract examined for zirconium. After a preliminary ether separation of ferric iron, the zirconium in the filtrate was precipitated as basic selenite by heating to boiling and adding hydrogen peroxide and selenium dioxide. The residue was heated with hydrofluoric and sulphuric acids, fusing with sodium carbonate and extracting with sodium carbonate solution. It was again fused with potassium pyrosulphate and extracted with sulphuric acid. The filtrate was treated with ammonia and the hydroxide dissolved in hydrochloric acid, and finally precipitated as the basic selenite as before. The precipitates were frequently contaminated by tungsten.

The same authors also described a combination of the phosphate and selenite methods for zirconium in steels.²⁶ A 3 g. sample was opened out as previously in hydrochloric acid/nitric acid. The solution was evaporated and baked at 105°C. for 30 minutes, after which the residue was extracted and washed with dilute hydrochloric acid. Both residue and filtrate contained zirconium. An ether separation was

selenious acid became dissolved in 12N sulphuric acid. After treatment with hydroxyl perhydrol was added to two filter papers. The precipitates were collected and washed with water until the main residue was removed. The filtrate was diluted with water and allowed to stand until the selenite was precipitated. The filtrate was then treated with 18N sulphuric acid and oxalic acid until the selenite was completely separated off.

Zirconium was dissolved in hydrochloric acid and the hydroxyl perhydrol was added to the solution. The precipitate of basic selenite thus obtained was combined with the first precipitate. The combined precipitates were dissolved and the zirconium re-precipitated as phosphate, ignited and weighed as ZrP_2O_7 .

The selenite method originally proposed by Smith and Jones²⁷ was more recently re-examined by Claassen.²⁸ The latter found that by long digestion with selenious acid, the precipitate obtained had the composition $Zr(SeO_3)_2$ and could be weighed after drying at 120–200°C. A volumetric finish was also evolved. In this case, the precipitate was dissolved in a mixture of 18N sulphuric acid and 3 per cent sodium fluoride. In this solution, hydrogen iodide reduced the selenious acid to selenium with liberation of free iodine. When both hafnium and zirconium were present, a fairly satisfactory analysis was made by weighing the ignited samples as $HfO_2 + ZrO_2$, and in another sample, titrating the excess of a standard solution of precipitant. The results of 30 analyses showed a good degree of precision.

A Russian worker has also applied the selenite method to steel analysis.²⁹ The sample was fused with alkali carbonate and interfering elements such as chromium, sulphur, phosphorus, tungsten, vanadium and aluminium were removed by extracting the melt with water. Na_2ZrO_3 and Na_2TiO_3 hydrolysed and remained in the residue which was fused with potassium pyrosulphate. The melt from this fusion was dissolved in dilute sulphuric acid and the zirconium brought down by means of ammonia. It was then re-dissolved in hydrochloric acid and precipitated as selenite.

Arsenite Method

Other than the phosphate and selenite methods, only one truly inorganic reagent remains to be considered, viz., arsenic acid. In 1925 Moser and Lessing,³⁰ studying the available methods for precipitating zircon-

ium, found that the existing methods for separating titanium and zirconium were unsatisfactory. Selective hydrolysis was found to be incomplete and the phosphate method required too much time. The cupferron method was said to be too expensive. As a new alternative, Moser and Lessing proposed disodium hydrogen orthoarsenate. When this was added to a solution of zirconium salts in nitric acid, a white precipitate of $ZrO_2 \cdot HAsO_4$, which was dense and easily filtered, was obtained. Titanium gave no precipitate.

Moser's & Lessing's Method

Having separated the zirconium from titanium in this form, Moser and Lessing dissolved the precipitate in concentrated sulphuric acid, added hydrochloric acid and hydrazine and distilled off the arsenic trichloride. Having removed all the arsenic in this way, the remaining solution was diluted and treated with excess ammonia. The precipitated zirconium hydroxide was dissolved in hydrochloric acid and re-precipitated. It was subsequently ignited and weighed as the oxide. The titanium in the original filtrate was brought down by treatment with sulphur dioxide and ammonia. Zirconium was similarly separated from cerium and thorium, but in the latter case it was necessary to restrict the nitric acid concentration to 1.1N.

Schumb and Nolan³¹ examined Moser and Lessing's method and further developed it. They found that zirconium was readily precipitated as insoluble $Zr_3(AsO_4)_4$ by addition of 1 per cent ammonium orthoarsenate to the boiling test solution. The precipitation was said to be best effected in 2.5N hydrochloric acid or not more than 3.5N nitric acid. Sulphuric acid interfered by preventing precipitation. When the precipitate was ignited in the presence of two filter papers, all the arsenic was found to volatilise leaving the zirconium behind to be weighed as ZrO_2 .

The precipitated zirconium arsenate was soluble in hot or cold hydrochloric and nitric acids and also in 6N sulphuric acid. Only titanium, tantalum and columbium precipitated at the acidity used. A separation from titanium in hydrochloric acid medium was obtained by adding hydrogen peroxide before the reagent. Co-precipitation was found when cerium, thorium, tungsten, titanium, etc., were present. Cerium was removed by re-precipitation. The

interference of tungsten was said to arise from the formation of a complex zirconium tungstate and its removal was recommended. This was done by alkali fusion and extraction of the melt with water. The zirconium in the residue was re-dissolved by fusion with potassium bisulphite.

About the same time, Axt³² also examined ammonium arsenate as a zirconium reagent. He fixed the acidity levels rather higher than the previous authors at 2.75N hydrochloric acid, 3.75N nitric acid and less than 0.5N sulphuric acid. Axt commented that the precipitate of $Zr_3(AsO_4)_2$ was frequently contaminated by the precipitant and rejected volumetric finishes as being unsatisfactory.

In 1943, Moser and Lessing's original method and the Schumb and Nolan modification were re-examined by Claassen and Visser.³³ A single precipitation in hydrochloric acid was shown to give a good separation from Cu, Cd, V, Mo, U, Ce, Fe, Al, Cr, Ni, Co, Zn, Mn, Mg, Cu, Sr, Ba and the alkali metals. A double precipitation was necessary with Bi, Be, Th, Sn and Ti. It is noticeable that cerium is not in the latter category, but in the former. Claassen and Visser recommended the following procedure. The sulphate free solution was made approximately 2N in hydrochloric acid and 10 per cent H_2AsO_4 was added with stirring at room temperature. The solution was diluted and maintained at boiling temperature for 30 min. After the precipitate had settled and was filtered, it was washed with 200–250 ml. of 0.5N hydrochloric acid containing 0.2 g. H_2AsO_4 in 100 ml. Finally, the precipitate was washed a few times with cold 2 per cent ammonium nitrate. It was ashed carefully and ignited to remove all the arsenic by sublimation and transferred to a platinum crucible where it was fumed with hydrofluoric acid and sulphuric acid and lastly ignited to zirconia at 1,000°C. The zirconia thus obtained was claimed to be free from silica and arsenic.

Sarudi's Technique

Sarudi³⁴ has also examined the arsenite method, but unlike previous authors he used Moser and Lessing's original precipitant, i.e. disodium hydrogen orthoarsenate. His recommended procedure differs little from those previously described. After separation of the zirconium as arsenate, and volatilisation of the arsenic, he dissolved the hydroxide in nitric acid and re-precipitated

it with ammonia. It was weighed as ZrO_2 after ignition. He also recommended that the original precipitate of $ZrO \cdot HAsO_4$ be weighed as zirconyl pyroarsenate ($ZrO \cdot As_2O_5$), but stressed that in this case an excess of reagent was to be avoided.

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(To be continued)

New Welding Process

THE first demonstration in Britain of a new type of welding equipment took place recently in Glasgow before a gathering of technicians. Used for Arcomatic welding the new equipment will be manufactured and distributed by the British Oxygen Co., Ltd., under the name of Argonaut, and will be shown at the forthcoming British Industries Fair.

Tungsten electrodes, used in argon arc welding, are replaced by a continuous aluminium filler fed automatically down the welding gun, inside a protecting envelope of argon gas. High current densities are achieved of the nature of a minimum 50,000 amps./sq. in. creating 'projected metal transfer' which shoots droplets of the filler at high intensity through the arc for deposition on the area at which the gun is pointed. The arc is self-adjusting and high speeds—some 20 to 48 inches per minute—on varying metal thicknesses, are said to have been achieved.

It is claimed that this faster, cheaper method of welding alloys and copper will replace previous methods and allow a major advance in the use of aluminium for a wide range of purposes. The British Aluminium Co., Ltd., have been co-operating in development of the new process and were the hosts at the Glasgow demonstration.

The Chemist's Bookshelf

THE MEASUREMENT OF PARTICLE SIZE IN VERY FINE POWDERS. By M. E. Rose. Constable & Co., London. 1953. Pp. 127. 9s.

This excellent monograph on a subject of considerable industrial importance is based upon the subject matter of a series of lectures given by the author during 1952. Each of the four lectures is published as an individual essay on a particular aspect of the main subject. The first deals with the necessity for particle size measurement, discusses size frequency and residue curves and limits the subsequent discussion to particle sizes between $1\text{ }\mu$ and $60\text{ }\mu$. Lecture 2 is concerned with Stokes's Law and with sedimentation and elutriation methods of analysis. Lecture 3 deals with the photo-extinction method of size frequency determinations and compares specific surface determination by photo-extinction and permeability measurements. Lecture 4 describes the determination of specific surface by absorption, tinting strength and bulk density tests and the use of diffraction rings for the determination of mean particle size.

The basic principles of each method are clearly stated and the theoretical aspects are sufficiently developed to provide a satisfactory basis for the subsequent treatment of the practical aspects. The simpler techniques and apparatus are dealt with in detail and each method of analysis is described and illustrated in such a manner as to permit the construction of suitable apparatus. The limits of error and difficulties inherent in each method are fully discussed so that a reader seeking a satisfactory method of analysis for a particular purpose has adequate information upon which to base his choice. For the worker directly concerned with problems of size separation and classification the book will be of considerable help as a guide to current developments and a stimulus to future research. To the non-specialist reader the book is a delightful introduction to a subject which prior to the Institution of Chemical Engineers and

Society of Chemical Industry Symposium on Particle Size Analysis in 1947, was inadequately treated in the technical literature.—F.M.

CHEMICAL ANALYSIS OF INDUSTRIAL SOLVENTS. By Morris B. Jacobs and Leopold Scheflan. Interscience Publishers, New York and London. 1953. Pp. 501 + xxii. \$10.00.

This is volume VII in the 'Chemical Analysis' series of monographs on analytical chemistry and its application, and to a large extent contains subject matter dealt with in the official publications of the American Chemical Society and the United States Pharmacopœia. The object of the authors has been to include within a single volume methods for the assay, detection and estimation of individual solvents and solvent mixtures, and such analytical procedures as may be necessary for the control of industrial processes employing these solvents.

The text contains fourteen chapters with the following headings:—'Introduction and Sampling,' 'Physical and General Methods,' 'Physical Chemical Methods,' 'Physiological Effects of Industrial Solvents,' 'General Methods for the Determination of Solvent Vapours,' 'General Methods for the Analysis of Solvent Mixtures,' 'Paraffin and Unsaturated Aliphatic Hydrocarbons,' 'Benzene, Aromatic and Hydrocyclic Hydrocarbons,' 'Halogenated Hydrocarbons,' 'Alcohols,' 'Glycols, Polyhydroxyl Compounds and Ethers,' 'Acids and Esters,' 'Ketones and Aldehydes,' 'Nitrogen and Sulphur Compounds.'

The first six chapters deal with sampling and general methods of analysis applicable to any solvent, e.g., determination of density, viscosity, flash point, etc. Chapters seven and eight deal with hydrocarbon analysis and give in addition to the normal ASTM methods of test details of specific tests for individual hydrocarbons or special solvents. Chapters nine to fourteen deal with groups of solvents classified by the pre-

dominating functional group. If the solvent is defined by ACS, USP, or ASTM specification these are given followed by methods of detection and methods of determination. The latter have been collected from all available sources and constitute the major part of the text. Limits of accuracy are not given but the comments at the beginning of each section indicate the relative merits of the various tests.

It is not surprising in view of the wide scope of the text that some useful analytical techniques have been omitted. This is particularly noticeable in the section on hydrocarbons and petroleum products where analytical methods for the determination of hydrocarbon types, such as refractivity intercept, Waterman Ring Analysis, etc., might well have been included. The inclusion of standard ASTM tests seems hardly necessary in view of the wide publicity already given to the ASTM Standard Methods. In certain cases reference to British and Continental specifications and official methods of test would have increased the usefulness of the text outside the U.S.A.

These are minor criticisms of a text which should prove of great value to laboratory workers engaged in the analysis of solvents. For the non-specialist the text affords a ready reference to a variety of test methods and gives details of a wide range of solvents.—F.M.

GENERAL AND INORGANIC CHEMISTRY. By Alexander Findlay. Methuen & Co. Ltd., London. 1953. Pp. xvi + 239. Figs. 12. 8s. 6d.

This little book is issued in the series of Home Study Books, and its avowed aim is 'not only to meet the needs of young readers who are designed for a scientific career, but also . . . to make appeal to the intellectual interest of those who, with other preoccupations, desire to gain knowledge and understanding of a branch of science on which much of our present-day civilisation depends.'

The book may be regarded as a very much simplified version of any orthodox school certificate textbook on general and inorganic chemistry.

The approach is quite classical, being by way of the orthodox historical account of alchemy, Dalton, Avogadro and the like, and dealing, in the systematic part, with the elements usually met in any elementary text

of the past fifty years. Indeed, for this very reason the book is disappointing. There is little in it, apart from isolated statements, that could not have been found in a book with a similar aim written twenty-five years ago. When one makes a mental comparison with recent American textbooks of about the same standard, written for the liberal arts students 'requiring' one year's chemistry, or for the intelligent layman, this book makes a very uninspired showing.

It is doubtful if, in the first stages of home study, those desiring to gain some knowledge and understanding of chemistry in relation to our present-day civilisation will wish, or indeed, ought to be presented with, say, Dulong and Petit's Law. They are really interested in finding out what titanium and tungsten are. These are not mentioned in the book, but are surely worthy of as much attention as manganese or cobalt. They will probably want to know much more about how an atomic pile produces radioactive isotopes, and how these are used, than is contained in the dozen or so lines allocated to this topic. They will find the two brief references to deuterium and heavy water little help in their understanding of the chemists' contribution to the present. The new developments in silicon chemistry are quite, and those in fluorine chemistry almost, ignored. The choice of Davy's safety lamp as one of the twelve illustrations needs some defence.

Much of this criticism is based, of course, on a definite attitude towards the teaching of chemistry to those categories of people who the book claims to reach. If you are of those who believe that the only way to modern chemistry, even for those who do not propose to earn their living by it, is by history and a consideration of the orthodox twenty elements, then you will approve of this book; for Professor Findlay's well-known clarity of style and his able exposition of those topics with which he has chosen to deal are only to be expected. But if you think that the history of a science is best comprehended by those who have a sound appreciation of the science itself, then you will take exception, not to the treatment, but to the choice of subject matter. You will wish that more imagination had been shown in selecting topics which will really seem, to the man in the street, to have some connection with chemistry today.—CECIL L. WILSON.

• HOME •

Coronation Holiday

Instead of closing for Whitsun and the August Bank Holiday this year, Fort Dunlop is turning both into a Coronation holiday from 1 to 3 June.

I.C.I.'s Billingham Plans

Dr. G. I. Higson, chairman of the Billingham Division of Imperial Chemical Industries, Limited, when making a presentation of clocks and watches to 120 long-service employees recently, declared that the factory site at Billingham was now nearly full. It was intended to use remaining land for plant of a more complicated nature, which would ensure more employment, together with more profit. Wilton, said Dr. Higson, was to be the home of many large new projects which the I.C.I. had in mind.

Name Altered

The board of directors of General Metallurgical & Chemical, Limited, with the approval of the Board of Trade, has, as from 30 March, approved the change in the name of the company to Gemec Limited. The firm manufacture in the United Kingdom the 'Gemex' Cationic and 'Nonex' Non-Ionic Compounds; are distributors for Carbide and Carbon Chemicals Company of New York; and distributors for Oxirane, Limited, of Manchester.

New Method of Fire-fighting

Promising results of new method of fire-fighting known as 'water fog' are reported following experimental trials by the Middlesex Fire and Ambulance Service. In the new method, which causes much less damage than the deluge from a conventional hose, water is discharged under pressure through a spray nozzle, and the fire is 'suffocated' as it is enveloped in mist.

New Factory Occupied

Stockdale Engineering, Ltd., chemical engineers, Deansgate, Manchester, announce their removal to a new factory in London Road South, Poynton, Cheshire. The increased facilities provided by this new factory will enable the ever increasing volume of business to be handled more expeditiously. The new building is designed on modern lines with chalet characteristics derived from Swiss architecture.

Steel Castings Research

A new research association for the steel founding industry has been formed. To be known as the British Steel Castings Research Association it will take over the organisation set up and staffed by the research and development division of the British Steel Founders' Association. The chairman is Mr. F. N. Lloyd, chairman and managing director of F. H. Lloyd & Co., Wednesbury. The policy of the BSCRA will be to arrange for the rapid application of research to production. A long-term programme of fundamental research will be undertaken.

Call for Controls

The London Political Committee of the Co-operative Party intends to ask the party's annual conference at Easter to demand the enforcement of existing laws, and to call on the Government for new legislation to protect food standards. It is suggested that chemicals used in the manufacture of many foodstuffs are injurious to consumer's health. A proposal will be made that the full composition of foodstuffs must be stated in the case of all preparations. The conference will also be asked to support a demand for a royal commission to examine the curative properties and prices of patent medicines and to prevent the manufacture and sale of spurious products.

Nominations Sought

Members of the Institute of Metal Finishing are reminded that nominations for three seats on the Council should be received by the hon. secretary, 32 Great Ormond Street, London, W.C.1, not later than 15 April. Each nomination must be supported by the signatures of at least six members of the Institute. A ballot, if necessary, will be held to elect the three members needed to fill the vacancies which will occur at the end of the current session.

Lancashire Refinery Fire

Many tons of oil were burned when fire damaged two sections of the Hess Products oil refinery at Littleborough, Lancashire, on 30 March. The outbreak is believed to have begun when boiling acid residues overflowed and reached some boilers. The refinery processes vegetable and animal fats for industrial uses.

OVERSEAS

Nickel and Oxide Allocations

The International Materials Conference announced in Washington on 27 March the allocation of 37,799 metric tons of primary nickel and oxides to 34 countries for the second quarter of this year. The United Kingdom will receive 5,526 metric tons compared with 5,433 metric tons in the first quarter.

Research Prizes

Chemical research workers are among those honoured in the 1953 distribution of Kossuth Prizes, just announced in Hungary. Prizes of £600 each go to Vilmos Keilwert, chemical engineer at the Láng Engineering factory, for directing the planning of the Debrecen Penicillin factory; and János Proszt, Professor of the Inorganic Chemistry Institute, for pioneering research in the preparation of organic silicon compounds.

Brazilian Caustic Soda Project

Contracts were signed in March between the National Alkali Company and Comptoir Internationale d'Achats et Ventes à l'Etranger, under which the latter opens a credit of U.S. \$12,000,000 to finance imports of equipment for the company's caustic soda factory at Cabo Frio. The installation work will be carried out by Société Krebs, of Neuilly-sur-Seine, and the National Bank for Economic Development (Brazil) will advance the equivalent of £3,600,000 to cover local expenditure. Imports of caustic soda and barilla at present cost Brazil £860,000 monthly.

Uranium Project in India

Important uranium deposits are said to have been found at Bihar according to a report submitted to Parliament by the Ministry of Natural Resources and Scientific Research. Uranium could also be extracted from monazite—a radioactive sand found on the beaches of Travancore and Cochin. According to the report, the Indian Atomic Energy Commission has decided to build a plant on Trombay Island, Bombay, for the processing of uranium to a state of atomic purity. Construction is expected to begin shortly.

Cobalt and Nickel Quotas

The United States Department of Commerce has announced export quotas for cobalt and nickel for the second quarter of 1953. The quantities are unchanged from those granted in the first quarter of this year. Britain has been granted a quota of 1,130,000 lb. for monel metal or nickel products compared with 970,000 lb. in the first quarter.

W. Germany Chemical Exports

Western Germany's chemical industry exported £180,000,000 of chemicals during 1952, a 16 per cent drop on the figures for 1951. Basic chemicals were almost unaffected by the decline, but the export of organic chemicals slightly increased. Three-quarters of the basic chemicals exported went to Europe, Britain and France, and a tenth to North and Central America. In contrast, exports of chemical fibres dropped almost by half. In 1952 Western Germany sold abroad DM.54,000,000 worth of cellulose and DM.50,000,000 of rayon.

Titanium Ore Find

A big deposit of titanium ore has been discovered on the Natal south coast and a South African mining company is carrying out development over a large area. Mining will begin this year. An experimental plant has been installed and samples of the first output sent to the United States. More than 1,000,000 tons of ilmenite ore containing 50 per cent titanium oxide are said to exist around Umgababa.

Molybdenum Quotas

Britain is to receive a quota of 500 metric tons of molybdenum out of a total of 6,736.25 metric tons allocated to 30 countries for the second quarter of 1953 by the International Materials Conference, Washington. Defence needs and requirements for increasing stocks were still in excess of estimated production.

To Encourage Prospectors

Exploitation of radium deposits believed to exist in Colombia is now controlled by a decree, passed in February. To encourage prospectors, the discoverer of any deposits will be allowed 5 per cent of the net exploitation results for a period of 10 years.

• PERSONAL •

His Royal Highness the DUKE OF EDINBURGH has graciously signified his willingness to become an Honorary Member of the Institute of Fuel.

There have been a number of changes in the Council of The Association of British Chemical Manufacturers since the beginning of the year.

MR. A. D. DAYSH (Monsanto Chemicals, Ltd.) and MR. H. YEOMAN (The Clayton Aniline Co., Ltd.) have retired and MR. D. SPENCE (Peter Spence & Sons, Ltd.) has resigned for business reasons.

MR. J. L. HARVEY (Spencer, Chapman & Messel, Ltd.), MR. B. HICKSON (Hickson & Welch, Ltd.) and DR. W. H. GARRETT, M.B.E. (Monsanto Chemicals, Ltd.) have become elected members, while MR. T. M. WILLCOX (The Clayton Aniline Co., Ltd.) have been co-opted to fill one of the vacancies thus created.

At the annual general meeting of the Association of Chemical and Allied Employers on 19 March at the May Fair Hotel, MR. E. P. HUDSON, assistant managing director of Scottish Agricultural Industries, Edinburgh, was elected chairman, and DR. W. G. HISCOCK, director of operations, Imperial Smelting Corporation, was made vice-chairman. MR. A. E. PEAK, chairman of Clayton Aniline Co., Ltd., was re-elected president and MR. I. P. LLEWELLYN, director of Peter Spence & Co., Ltd., treasurer.

The *Perfumery and Essential Oil Record* announce the appointment of MR. W. R. LITTLEJOHN, B.Sc., A.R.I.C., F.C.S., as editor with effect from 1 April, 1953. Mr. Littlejohn is a member of the Society of Public Analysts, The Society of Chemical Industry, The English and French Cosmetic Societies, Associate of the Institute of Chemistry, Fellow of the Chemical Society, Oil and Colour Chemists' Association, member of the British Standards Institution and the Colonial Products Advisory Committee. He has contributed many articles to the trade Press.

MR. E. F. MACTAGGART, B.Sc., M.I.Chem.E., director of the Sondes

Place Research Institute, left by air at the beginning of April on a series of visits in connection with overseas research and development contracts. His trip will take him to Paris, Beirut, Karachi, Colombo, Singapore and Hong Kong, and he will return via San Francisco, Washington and New York.

MR. BERTRAM WHITE, Technical Director of the Federation of British Industries, has resigned as from 31 March, 1953, to take up an industrial appointment.

DR. J. E. G. HARRIS, D.Sc., Lond., B.A. Cantab., will succeed him temporarily as Acting Technical Director. Dr. Harris had a long association with Imperial Chemical Industries Ltd. from whose service he has now retired.

At the annual general meeting of The Chemical Society held in Burlington House on 27 March, the following elections of the council were declared:—*Vice-president*:—PROFESSOR R. D. HAWORTH; *members of council*: PROFESSOR F. BERGEL (London), PROFESSOR M. J. S. DEWAR (London), DR. J. FAULKNER (Billingham), PROFESSOR BRYNMOR JONES (Hull) and DR. A. I. VOGEL (London).

MR. C. E. PROSSER has been appointed chairman of the Metals Division of Imperial Chemical Industries Ltd., in succession to MR. H. E. JACKSON who relinquished the chairmanship on 31 March. Mr. Prosser has been a director of I.C.I. Metal Division since 1936.

MR. WILLIAM MCNEAR RAND has resigned as a member of the board of directors and of the Finance Committee of Monsanto Chemical Company in the U.S.A. His resignation follows the confirmation in the U.S. Senate of his appointment as deputy director of the Mutual Security Administration. Mr. Rand joined the Merrimac Chemical Company in 1920 which was taken over by Monsanto Chemical Company in 1929. He became a member of Monsanto's Board of directors in 1933 and was made president in 1945, from which position he retired in 1951.

Anchor Chemical Company

Falling Prices Helps Restrict Demand

THE 46th annual general meeting of the Anchor Chemical Company was held on 23 March at Clayton, Manchester, when the chairman announced that profits for the year ended 30 November, 1952, totalled £54,066. Out of this sum £31,545 had been allocated to cover taxation liabilities at current rates, leaving a net trading profit after taxation of £22,521 against a corresponding figure of £66,329 for the proceeding year. After taking into account the undistributed balance of profits (£57,252) brought forward from last year, there was a total sum of £79,773 available for distribution. A final ordinary dividend of 17½ per cent was declared for the year ending 30 November, making the total ordinary dividends for the year 25 per cent compared with 27½ for the proceeding year.

Trading had been very difficult, the chairman stated. During 1952 the fear of falling prices, among other things, had restricted demand and consumers generally had reduced their stocks. Despite this, sales were two-thirds of the 1951 record total. Due, however, to the fight for business and the keen competition from all over the world, margins were reduced.

Overseas Sales

Overseas sales achieved 75 per cent of the previous year's record total in spite of the full force of world competition and Australia's import restrictions. In place of an insatiable demand and restricted supplies the position had completely changed. An encouraging response had been received on a number of special products and the firm was continuing working to expand exports.

The development of the manufacture of domestic carbon black in this country had affected the earning of their subsidiary, The United Oil and Natural Gas Products Corporation, Ltd., but this had been expected and shareholders had been made aware of the situation in the annual reports for the last few years. They had, however, for some years been in close contact with their American carbon black producers regarding supplies for the United Kingdom, and it was hoped that some solution would be found before long and that they would be able

to offer supplies of home-produced furnace carbon black.

The firm's development plant had recently been modified to enable them to commence small scale manufacture of an American rubber chemical used extensively in the rubber trade. If the production was satisfactory they had plans to enlarge the plant as the American owners of the rights permitted the sale of the product not only in this country but in many countries abroad.

Products for the rubber latex industry were proving very satisfactory and the demand was such that they were having to extend plant and remove it to more spacious buildings.

The company's service laboratories were still very actively engaged in co-operating with rubber manufacturers throughout the world on their problems as well as in evaluating possible new raw materials, including those developed in their research laboratories and those which were offered by other manufacturers as possibilities for the rubber industry.

The British Anchor Chemical Corporation, their subsidiary in New York, had rendered great service during a very difficult year. They had given first-hand news of developments in the United States and had maintained contacts with the rubber and chemical industries over there. They had assisted to develop the sale of American chemicals, many of which were not produced in the United Kingdom.

Oxidation Symposium

The Oils and Fats Group of the Society of Chemical Industry will hold a symposium on oxidation at The Low Temperature Research Station, Downing Street, Cambridge, on Friday, 24 April. The speakers will be Professor C. E. H. Bawn, Dr. C. H. Lea, Dr. A. Banks, Dr. L. A. O'Neill and Dr. J. H. Skellon. The subjects they have chosen are 'Some Recent Developments in the Study of Oxidative Deterioration of Lipids,' 'Some Observations on the Autoxidation of Linoleic Acid,' 'Some Recent Studies on the Autoxidation of Drying Oils,' and 'Recent Research on Oxidation of Monoethenoid Fatty Acids and Esters.'

Company News

British Industrial Solvents

As part of an internal re-organisation, British Industrial Solvents, Limited, will cease trading as a separate limited company at midnight 31 March, 1953, and transfer the whole of its business to a new division of its parent company, The Distillers Co., Ltd. This division will be operated by the present management and staff of British Industrial Solvents, Limited.

Following this change of constitution, the business will be conducted from 1 April, 1953, as 'British Industrial Solvents—a division of The Distillers Co., Ltd.'

The B.I.S. Division will undertake responsibility for all the outstanding commitments and liabilities of British Industrial Solvents Limited.

The Distillers Company

The Distillers Company, Limited, has decided, with a view to unifying administration, to reorganise certain of its industrial activities.

In the case of The Distillers Company (Biochemicals), Limited, the reorganisation involves the transfer of its major assets to the parent company with effect from 31 March. At the same time the name of the company will be changed, thus enabling a new company to be formed with the same name.

The new company (The Distillers Company [Biochemicals], Limited) will operate the factory at Speke and conduct the whole business in the same way as formerly but as agents for the parent company, The Distillers Company Ltd.

Petrochemicals Ltd.

At a meeting in London on 27 March, Sir Robert Renwick closed his association with Petrochemicals, Ltd. In his closing address he said that real progress had been made in the last twelve months, with operation savings at the rate of over £500,000 yearly. There was no other petroleum chemical plant in Europe today which lent itself better to future development. He regretted that on present reduced throughput, profitability was seriously affected, but reiterated his conviction that by intensive sales activity and by widening the range of end-products, that problem could be solved.

Change of Name

At an extraordinary general meeting of Laporte Chemicals, Limited, held on Friday, 27 March, the name of the company was changed to Laporte Industries, Limited.

Other changes of name are as follows: British Chemicals & Biological (Export), Ltd., to Fisons Chemicals (Export), Ltd., on 3 March, 1953.

New Registrations

Alchem Processes Ltd.

Private company. (517,328.) Capital £1,000. Chemical engineers, etc. Directors: D. L. Shaw, and J. I. Peters. Reg. office: 36/8 Peckham Road, S.E.5.

Ashburton Chemical Works Ltd.

Private company. (517,524.) Capital £750,000. Manufacturers of colours, dye-stuffs, pigments, paints, oils, bleaches, drugs and other chemical products, etc. First directors are not named. Reg. office: 21 Spring Gardens, Manchester.

Brekma Salts Ltd.

Private company. (517,746.) Capital £500. Manufacturers of chemicals, drugs, medicines, salts, acids, etc. Directors: W. Nicholas and M. E. Nicholas. Reg. office: 249 Oxford Street, Swansea.

British Industrial Solvents (Kenfig) Ltd.

Private company. (517,403.) Capital £100. Manufacturers of acetic acid, acetone, butyl alcohol, esters and other forms of chemicals and chemical products, etc. First directors are to be appointed by the subscribers. Reg. office: 4 Cavendish Square, W.1.

Geigy Co. Ltd.

Private company. (517,545.) Capital £250,000. Dealers in colours, dyestuffs, pigments, paints, oils, bleaches, drugs and other chemical products, etc. First directors are not named. Reg. office: 21 Spring Gardens, Manchester.

Next Week's Events

TUESDAY 7 APRIL

Society of Chemical Industry

London: 26 Portland Place, W.1, 6.30 p.m. Plastics and Polymer Group. Dr. M. Gordon and J. S. Taylor: 'Recent Advances in the Ionic Reactions of Rubber.'

WEDNESDAY 8 APRIL

Society of Chemical Industry

London: Burlington House, Piccadilly, W.1, 6.30 p.m. Annual general meeting of The Food Group, followed by the chairman's address: 'Food Science, The Food Group and the Future.'

THURSDAY 9 APRIL

The Chemical Society

Dundee: University College, 5.15 p.m. Dr. G. Gee: 'Some Equilibria and Reactions with Sulphur.'

Institute of Metal Finishing

Manchester: Engineers' Club, Albert Square, 7.30 p.m. H. E. Hutchinson: 'Silver Plating.'

Liverpool Metallurgical Society

Liverpool: The Temple, Dale Street, 6.30 p.m. Annual general meeting, followed by Dr. W. S. Owen: 'The Basic Processes Involved in the Tempering of Plain Carbon and Low Alloy Steels.'

Institute of Welding

London: Caxton Hall, Westminster, S.W.1, 6.30 p.m. South London Branch. annual general meeting, followed by debate that 'This Meeting Regrets that Standardised Inspection Tests Are Not Statutorily Compulsory on All Welded Work.'

FRIDAY 10 APRIL

The Chemical Society

Manchester: The University, 6.30 p.m. Joint meeting with the RIC and the SCI. Dr. M. W. Goldblatt: 'Nature of Toxic Action.'

Society of Public Analysts

Edinburgh: George Hotel, 7.15 p.m. Scottish Section. Meeting on: 'Modern Methods of Analysis in the Training of the Student.'

Oil & Colour Chemists' Association

Manchester: Grand Hotel, 6 p.m. Annual general meeting.

Society of Glass Technology

Manchester: Trafford Park, visit to the Carborundum Co., Ltd.

Institute of Welding

Birmingham: James Watt Memorial Institute, Great Charles Street, 7 p.m. Annual general meeting of the Birmingham Branch followed by technical films.

SATURDAY 11 APRIL

Institution of Chemical Engineers

Manchester: The College of Technology, 3 p.m. North Western Branch. F. H. Garner (Member), S. R. M. Ellis (Associate Member) and A. J. Hugill: 'Efficiency of the Kaskade Distillation Column.' (Repeat of a paper delivered to the Midlands Branch, Birmingham, on 6 December, 1952).

Market Reports

LONDON.—The movement of most sections of the industrial chemicals market during the past week has been good, and reports indicate a steady expansion in new business both for home account and for shipment.

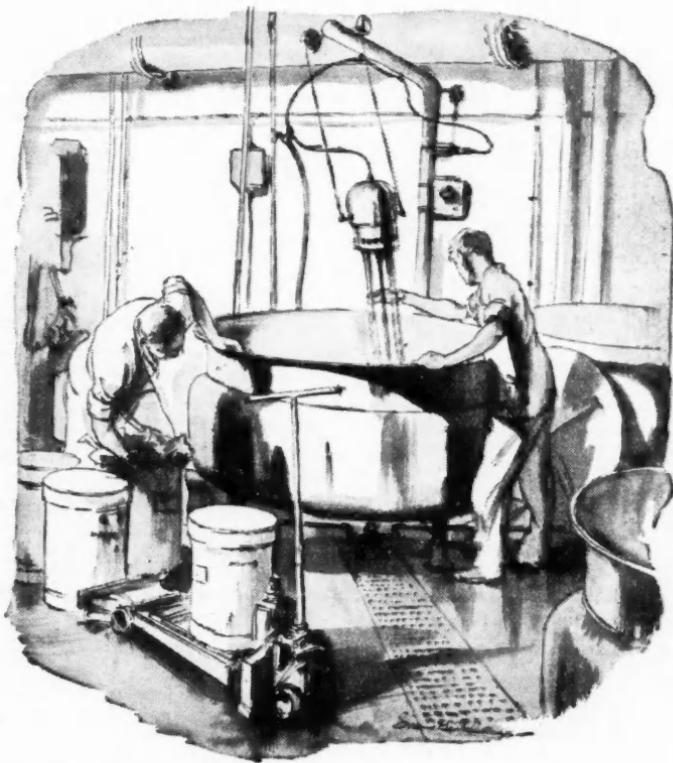
The chief price movement of the week has been a reduction of £2 per ton in acetic acid quotations. The new rates operate as from 30 March. Acetic acid, 80 per cent pure, is currently quoted at £92 per ton for ten-ton lots, and acetic anhydride, for one-ton lots, is now £138 per ton.

Among the coal tar products there has been a fair activity in light distillates with toluol in strong request. Pitch and creosote oil continue to find a ready outlet.

MANCHESTER.—The price position has again been maintained in pretty well all sections of the Manchester chemical market during the past week, though traders are anticipating the usual seasonal hold up of deliveries in Easter week. Caustic soda and most of the other soda compounds are being taken up in reasonably good quantities by home users and there has been a fair call for the potash chemicals, as well as for the ammonia and magnesia products. Export business in the leading lines keeps up fairly well. Superphosphates and the compounds, among the fertiliser materials.

GLASGOW.—Although trade on the whole is still fairly quiet there was a slight improvement in demand for a fairly wide range of industrial chemicals and a fair number of good orders have been booked for prompt delivery. With regard to export, there is little change to report either way.

As raw materials, pure chemicals simplify manufacturing problems and reduce costs. They mean fewer rejections and a product of better quality.



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LC P.3

CLASSIFIED ADVERTISEMENTS

EDUCATIONAL

THE INSTITUTION OF CHEMICAL ENGINEERS

29TH (1953) ASSOCIATE MEMBERSHIP EXAMINATION

APPLICATION forms (returnable June 1st, 1953) and particulars of the 29th Associate Membership Examination, may be obtained from the Secretary, INSTITUTION OF CHEMICAL ENGINEERS, 56, VICTORIA STREET, LONDON, S.W.1. Sections C, D, E and F of the examination will be held in September, 1953, and the Home Paper (Sections A and B) will be issued at the end of September for return 15th December, 1953.

SITUATION VACANT

The engagement of persons answering this advertisement must be made through a Local Office of the Ministry of Labour or a Scheduled Employment Agency if the applicant is a man aged 18-64 inclusive, or a woman aged 18-59 inclusive, unless he or she, or the employment, is excepted from the provisions of the Notifications of Vacancies Order, 1952.

ASSISTANT CORROSION ENGINEER required by KUWAIT OIL COMPANY for service in Kuwait. Should possess a Degree in Electrical or Chemical Engineering or Metallurgy, but Higher National Certificate in any of these subjects plus a full recognised engineering apprenticeship would be acceptable. Experience in Corrosion Engineering an advantage but not essential, as successful candidate will undergo some training in the U.K. Age 22-30. Overseas salary, starting £790 per annum clear, plus generous allowances, Pension Scheme and kit allowance. Write for application form, giving personal details and quoting K.1676 to BOX W/18, c/o 191, GRESHAM HOUSE, E.C.2.

FOR SALE

ECONOMIC BOILERS—9 ft. diam. by 12 ft. 6 in. Foster Yates, 200 lb. w.p.; 8 ft. diam. by 14 ft. Paxman, 180 lb. w.p. Twenty others, all sizes.

NEW GALVANISED PIPING. Immediate delivery. Johnson Filter PRESSES, 25 in., 18 Frame, practically new.

FIVE new FURNACE RETORTS, 8 ft. diam., 6 ft. 8 in. deep, approx. 8 tons each. Welded Steel.

FIVE Dish-ended NAPHTHA TANKS, 18 ft. 6 in. long by 4 ft. 4 in. diam., two having agitators.

TWO 35 ft. long by 9 ft. diam. Lead-lined TANKS. Stainless Steel FILTER TANK, 3 ft. 6 in. diam.

ONE Stainless CONICAL HOPPER, 7 ft. 3 in. diam., overall depth, 7 ft. 6 in.

TWO Broadbent WATER-DRIVEN CENTRIFUGES, 30 in. diam., 12 in. deep, 1,150 r.p.m., 150 lb. pressure.

FOUR Papier-mache O.T. TANKS, 8 ft. 3 in. diam., 9 ft. deep. (Unused.)

SIX O.T. TANKS, 7 ft. diam. 14ft. deep, lined inside with acid-resisting bricks.

SIX Aluminium CONDENSERS, 14 ft. long by 2 ft. 6 in. diam., 386 Tubes, 4 in. o.d.

ONE Rectangular Lead-lined TANK, 8 ft. by 4 ft. 6 in. by 2 ft. 6 in.

FORTY Riveted RECEIVERS, 8 ft. 6 in. long, 5 ft. 6 in. diam., 75 lbs. w.p.

CAST-IRON PIPES, 5000 ft. Each 6 in. and 8 in. NEW VALVES in Stainless, Gunmetal, Enamel Lined.

Free Catalogue, "Watkins Machinery Record," available

FRED WATKINS, COLEFORD, GLO.

FOR SALE

600

PROCESS PLANT

TWO 72 in. HYDRO EXTRACTORS by Thomas Broadbent, 72 in. galvanised basket, 20 in. deep, 1 in. perforations. Motorised 400/3/50.

Five Electric MAGNETIC SEPARATORS by H. G. Richardson, Reco type D.83, 180v., 1 amp.

Two Steam-jacketed ROTARY VACUUM DRYERS, each 17 ft. 3 in. by 4 ft. 6 in. diam. Manhole in barrel with cover. Mounted on roller tracks and driven through glanded trunnion bearings. Discharge through S.J. chamber.

Gas-fired OVEN by Bertram Thomas. Internal dimensions 3 ft. wide by 3 ft. 3 in. high by 2 ft. 6 in., with removable framework for trays. Two burners fitted Governor and Sparsom Regulator. Double swing doors.

Three Unused Horizontal M.S. Steel-jacketed DISINFECTORS by Thresh. Internal dimensions 6 ft. by 43 in. diam., with swing door each end. Steam jacket 7 lb. pressure. Galvanised cradle. New 1944.

Seven FILTER PRESSES, plate and frame type, each with 51 frames forming cakes 29 in. sq. by 2 in. Individual plate discharge. Plates have ribbed surfaces.

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STANNINGLEY, NR. LEEDS.

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CHARCOAL, ANIMAL AND VEGETABLE, horticultural, burning, filtering, disinfecting, medicinal, insulating; also humus ground and granulated; established 1830; contractors to H.M. Government.—THOS. HILL-JONES, LTD., "INVICTA" MILLS, BOW COMMON LANE, LONDON, E. TELEGRAMS: "HILL JONES, BOCHURCH LONDON," TELEPHONE 3385 EAST.

30 CWT. CHAIN BLOCKS, 10 ft.-12 ft. lift, ex-Government surplus. £15 per set.

5 CAST-IRON JACKETED FANS, 36 in. diam. by 27 in. deep, 14 in. bottom outlet. £20 each.

1 MILD STEEL WELDED OPEN-TOP TANK, 60 in. by 27 in. by 42 in. by 4 in. plate. £25.

THOMPSON & SON (MILLWALL), LTD., CUBA STREET, MILLWALL, E.14. TEL. EAST 1844.

PHONE 98 STAINES

TWO Stainless Steel 50-gal FANS, 2 ft. 2 in. by 2 ft. 6 in. deep.

Ditto, 100 gal., 3 ft. 6 in. by 3 ft. deep, with electric agitator.

Stainless Steel Jacketed Gas-heated Cylindrical MIXER, 22 in. by 36 in. deep (approx. 40 gallons). 400/3/50.

Stainless Steel GARDNER MIXER, 5 ft. by 18 in. by 20 in. deep—tot. end. Electrically driven, 400/3/50.

Two small Electric HYDROS (stainless steel baskets), 11 in. by 12 in. deep—200/1/50.

5,000, 1,200, 1,000 gal. Welded Underground Cylindrical STORAGE TANKS. Ditto, riveted, up to 32,000 gal.—30 ft. by 9 ft. diam.

EXTRUDERS with 5 in. and 7 in. diam. dies, water cooled.

BOILERS, CONDENSERS, "Z"- AND FIN-BLADE MIXERS, PUMPS, STILLS, HYDROS, CONVEYORS, ETC.

Lists on request.

HARRY H. GARDAM & CO., LTD., STAINES.

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FOR SALE

JACKETED INCORPORATORS, double "Z" arms, double geared, power-driven tipping motion, with counterbalancing weights.

1—Baker Perkins **MIXER** as above, not steam jacketed, single geared, complete with 25 h.p. A.C. motor.

2—Baker Perkins and Werner **Jacketed MIXERS** screw tipping pattern, friction pulley drive, single geared, with double-flat type agitators.

4—Gardner **RAPID SIFTER MIXERS** and **MIXERS** only, various sizes, one with brass fitted interior and glass-lined end plates.

27—Various **POWDER DRESSING** or **SIFTING MACHINES**, totally enclosed with barrels from 80 in. long by 22 in. diam. to 120 in. long by 30 in. diam., belt driven with collecting worm in hopper bottoms.

1—Simon Horizontal **Tubular DRIER**, 12 ft. long, 100 lb. steam pressure, size 3B, requiring 12 b.h.p.

4—Recessed Plate **FILTER PRESSES**, 30 in. square, 70 plates in each, centre fed.

5—Johnson **FILTER PRESSES**, 24 in. square, side feed and enclosed delivery, fitted 29 plates and 30 frames.

1—Johnson **FILTER PRESS**, 36 in. square, plate and frame type, double inlet and enclosed delivery ports.

Johnson Oil **FILTER PRESS**, Premier type plates 2 ft. 8 in. by 2 ft. 8 in., of which there are 45, with angle lever closing gear.

1—Johnson **FILTER PRESS**, 42 C.I. plates, 32 in. square, centre feed.

Steam-heated **FILTER PRESS**, Premier type, 32 in. square, with 30 recessed plates.

Wood **FILTER PRESS**, fitted 69 ribbed plates, 2 ft. 8 in. square, with top centre feed and bottom enclosed delivery channel.

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Particulars of the proposed amendments were set forth in the Official Journal (Patents), No. 3346, dated 1st April, 1953.

Any person may give Notice of Opposition to the amendment by leaving Patents Form No. 36 at the **PATENT OFFICE, 25, SOUTHAMPTON BUILDINGS, LONDON, W.C.2**, on or before 1st May, 1953.

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THE Proprietor of British Patent No. 574803, entitled "APPARATUS FOR THE TREATMENT OF BLOOD," offers same for licence or otherwise to ensure practical working in Great Britain. Inquiries to SINGER, STERN & CARLBERG, 14 EAST JACKSON BOULEVARD, CHICAGO 4, ILLINOIS, U.S.A.

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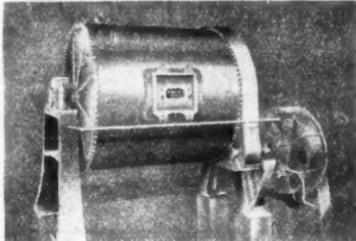
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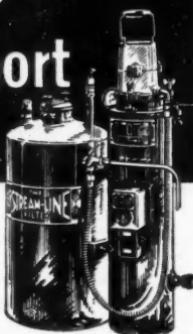
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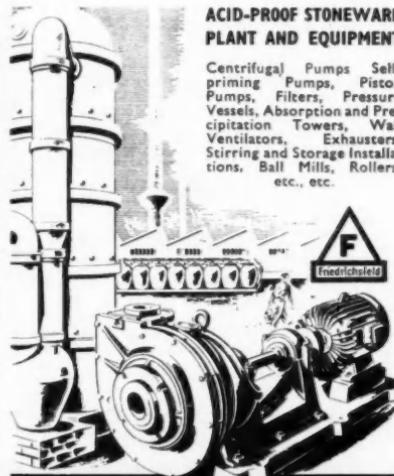
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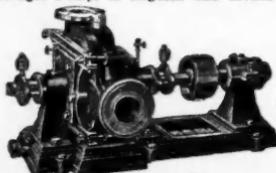
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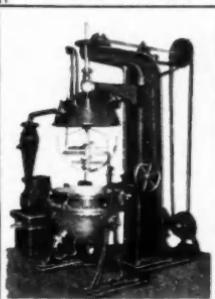
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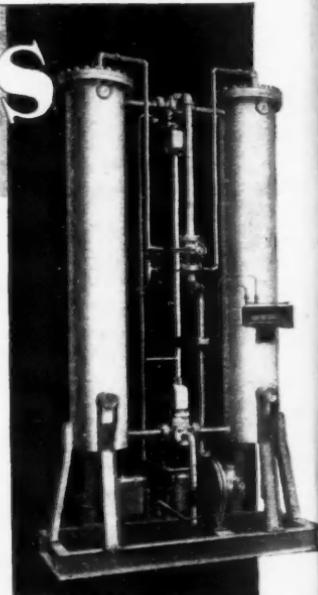
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